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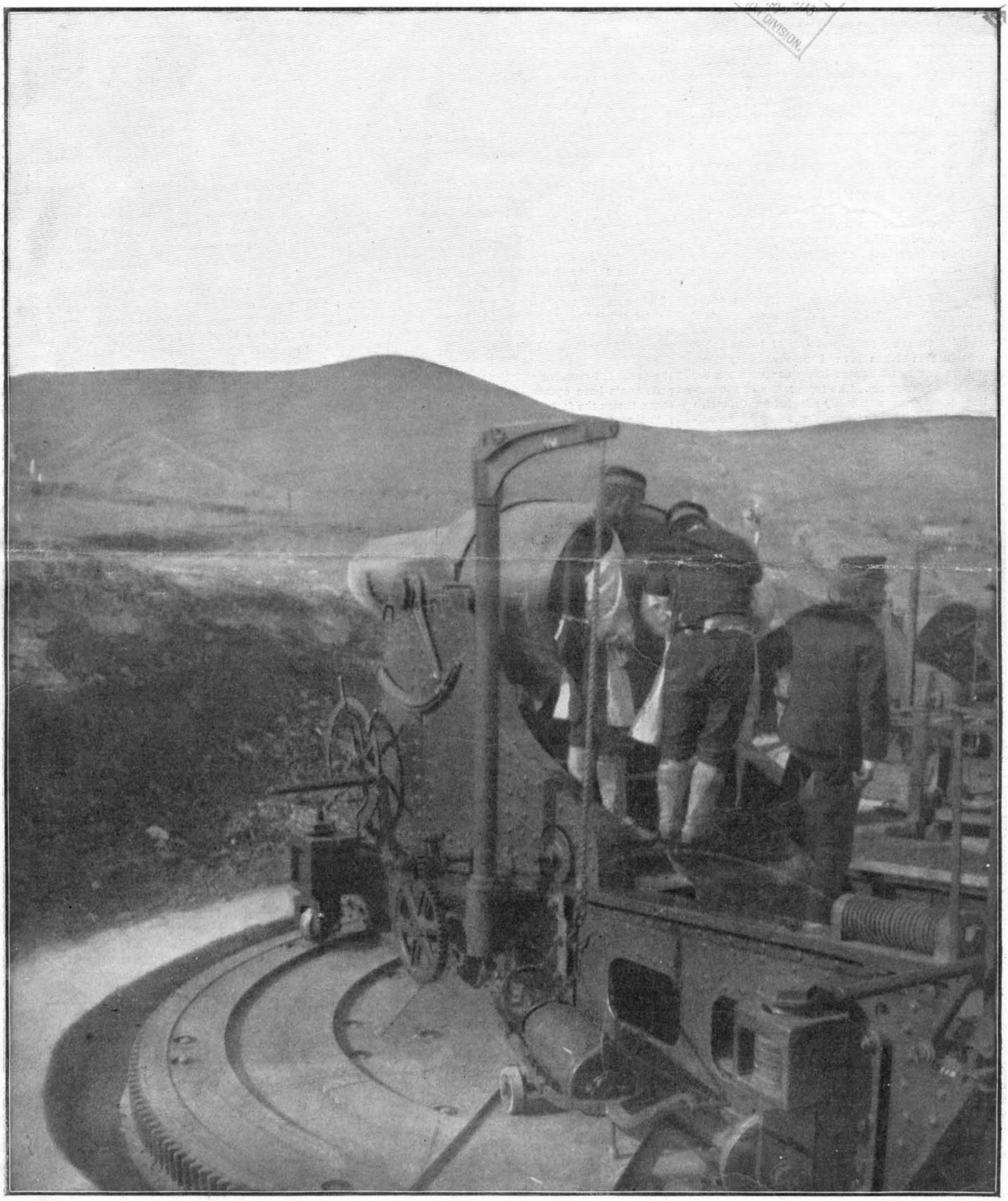


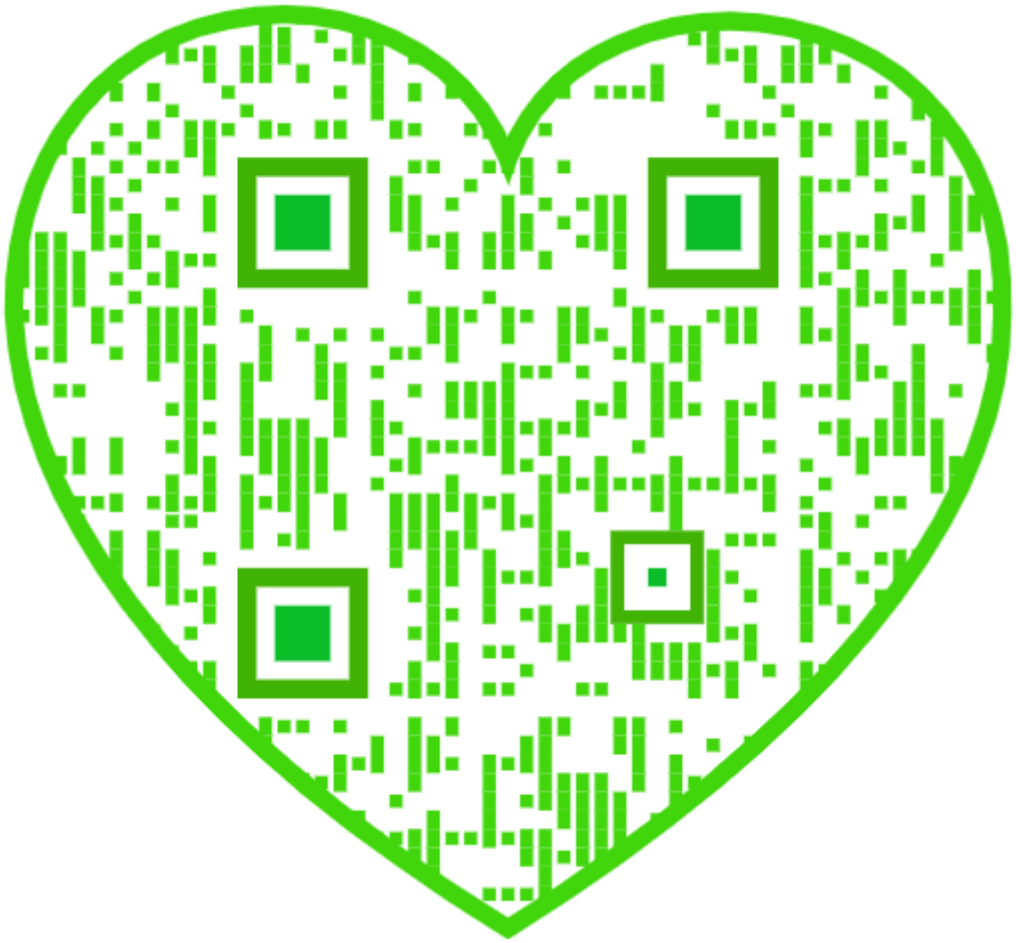
Eighteen of these mortars were emplaced in distant valleys, hidden from the view of the Russian Forts. Aiming was directed by observers stationed on 203-Meter Hill, who telephoned the effect of each shot. The shells passed high over the hills seen in the background, and fell, literally, like a thunderbolt out of the sky, upon the doomed fortress and fleet.

Photo. by Richard Barry, Special Correspondent at Port Arthur.

Loading One of the 11-Inch Mortars that Wrecked the Fortifications and Sank the Russian Fleet.

THE BOMBARDMENT OF PORT ARTHUR.—[See page 24.]

Photo. copyrighted 1905 by Munn & Co.



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NEW YORK, SATURDAY, JANUARY 14, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LESSONS OF THE JAPANESE WAR.

The capture of Port Arthur marks the tragic close of the first stage of the Russo-Japanese war; for although, as we pointed out in these columns a few weeks ago, the destruction of the Port Arthur fleet was the primary object of the investment, the capture of the fortress itself will be looked upon by the world at large as being, thus far, the most signal success of the war. It is superfluous to speak in praise of the heroism displayed by all ranks of the besiegers and the besieged. The story of the siege, as it appeared in the daily press, speaks for itself. In the display of desperate courage the siege of Port Arthur may have been equaled in some notable sieges of history, but it is certain that it has never been surpassed. Port Arthur bore the reputation of being one of the most impregnable of fortresses. The topography of the surrounding country was admirably adapted for defensive works, and its fortifications were constructed according to the latest theories of military engineering. It was defended by intelligent officers and disciplined and hardy troops, yet its fall has taken place within five months from the time it was closely invested, or in three to four months shorter time than it took the allied armies of England and France to reduce Sevastopol. Evidently the fortifications cannot be built that must not give way ultimately to sapping and mining. If the invading force has a sufficient reserve of men to make good the losses, it is only a question of time when zigzag trenches will be carried up sufficiently close to the walls of the fortification to enable the tunnels to be driven and the high-explosive mines laid that will blow the most massive parapets to pieces, and leave the fort open to be taken by storm. It is the trench and the mine that brought about the fall of Port Arthur. Another lesson of the siege is that in planning harbor fortifications too much attention cannot be given to laying out adequate defenses on the land side. It cannot be denied that many of the seacoast fortifications of the United States, unassailable though they be from the sea, are entirely open to successful attack by land.

THE TORPEDO BOAT.—Of the naval lessons of the war, surely the most valuable, and certainly the most surprising, is the comparative inefficiency of the torpedo boat. In not a single case has the torpedo boat been able to send a warship to the bottom. In the first attack at Port Arthur, although the Russian ships were at anchor and totally unprepared, the two battleships and the cruiser that were squarely torpedoed remained afloat, and were able, next morning, to steam in and beach themselves for investigation and repair of the damage. The only possible exception was the cruiser "Boyarin," and in her case it is possible that it was a floating mine and not a torpedo from a destroyer that sank her. It seems to be impossible for a torpedo boat to get within range, either by day or by night, of a warship that is on the alert; and when she does, the chances of making a hit are very remote. In the various engagements, torpedoes appeared to have been fired by the score without finding the mark (except in the night surprise of February 8), a notable case being that of the battleship "Czarevitch," which, after being terribly crippled by the concentrated fire of four Japanese battleships, and with her speed cut down to 4 knots an hour, was subjected to a night attack by the Japanese destroyers, and yet seems to have been able to beat them off and to make port the next morning without being once struck by a torpedo. By all the laws of torpedo-boat warfare, she should have been sent to the bottom in short order. On the other hand, the destroyers have developed unexpected ability for doing duties which were supposed to belong to the cruiser of 2,000 to 5,000 tons displacement. They have kept the sea, and have done splendid scouting work in all weathers. The future destroyer will probably be of from 500 to 600 tons displacement, and to her will fall, very largely, the picket and scouting duties which previously were supposed to be beyond her legitimate sphere of work.

THE BATTLESHIP.—No less surprising than the bursting of the torpedo-boat bubble is the remarkable ability developed by the battleship and large cruiser to receive the blow of the torpedo without being permanently crippled. Battleships and even cruisers have been torpedoed, and therefore (theoretically) destroyed, only to appear in a few weeks' time in the fighting line, apparently capable of putting up a stubborn fight of many hours' duration. In the sortie of August 10 there were four Russian battleships and one cruiser, that had previously been either torpedoed or struck by floating mines. Yet they were able to keep station for hours and steam at good speed in spite of a deadly hail of 12-inch shells from the Japanese fleet. Even more remarkable does the indestructibility of the battleship by the torpedo appear, when we remember that the repairs to the damaged ships were executed in a beleaguered harbor that was subject to the plunging shell fire of the enemy. Furthermore, some of the ships that stood the hammering of that long afternoon fight of August 10 had been mined or torpedoed and repaired more than once during the previous few months of the siege.

Surely the most ardent advocate of the torpedo and the torpedo boat will now admit that the battleship has won out in a fair fight between the two; and probably from this time on we shall hear very little talk about the abolition of the great fighting ship and the substitution of a mosquito fleet of destroyers. Not only has the battleship demonstrated its powers of successful resistance against what was supposed to be the most stupendous destructive engine of modern times; but it has proved itself to be, on every possible point of comparison, the supreme fighting unit of modern naval warfare. In all the operations under Togo, the battleship has formed the floating base from which the protected cruisers and the various flotillas of torpedo boats have operated. When the stress of battle came, it was the foot-thick armor on waterline and turrets that enabled the battleship squadron to stand up against the heaviest artillery of the enemy; and it was the 12-inch guns of the battleships that time and again drove the Russian fleet into Port Arthur, finally holding it there until the siege mortars of the Japanese army completed the work of destruction. What armor plate and cellular and compartment subdivision have done for the defense of the battleship, the heavy-caliber gun has accomplished, as its means of attack. More, even, than in Napoleon's day is it true that "Providence is on the side of the heavy artillery;" and the Japanese with their rare military instinct have been the first to realize that the victory of the future will lie with the ship that carries the biggest guns and the best gunners, and that can show the highest speed. Modern face-hardened armor has done everything that was asked of it. As far as is known at present, no gun protected by heavy armor has been put out of action by the penetration of that armor; and it will probably be revealed when the war is over that the "shots below the waterline," to quote the Russian dispatches, by which several of their ships were disabled, were plunging projectiles, which, striking the water just before they reached the ship, retained sufficient velocity on reaching the hull below the armor belt, to penetrate the shell of the vessel. If this be so, we shall probably see the belt armor extended a foot or two deeper below the waterline.

THE ARMORED CRUISER.—Another fighting unit that has vindicated its design is the armored cruiser. Of this type the Japanese navy possessed eight at the opening of the war, and they have all been conspicuously employed in the various operations. They have taken part in the bombardments of Port Arthur, and in the various naval engagements, two, at least, of them taking their place in the first line with the battleships, and placing their 8-inch shells with telling effect on the Russian ships. The destruction of the Vladivostock fleet was accomplished by the armored cruiser division under Kammimura. Judging from the frequency with which practically every one of these eight ships has been mentioned during the war, they seem to have done continuous duty—a fact that speaks well for their endurance, particularly when we remember that at one time or another they have probably all come under the fire of the heavy guns both of the Russian fortifications and the battleships.

THE MAN BEHIND THE GUN.—If asked to name the most important lesson of the war, at least on the naval side of it, we answer without hesitation that it is the supreme importance of an efficient personnel. The officers must be absolute masters of the theory and practice of their profession, and the men must be subject to the most rigid discipline, and possessed of unbounded faith in their officers. The events of the war have proved to a demonstration that the Japanese personnel is as conspicuous in these qualities as the Russian personnel is deficient in them. To this fact first and last is to be attributed the unbroken success of the one navy, and the unending string of disasters that has befallen the other. At the opening of the war there was little to choose in fighting efficiency, at least on paper, between the two fleets. The navy was composed of some of the very best ships the genius of Russian, French, and American shipbuilding yards could design and turn out; and its complete annihilation in the brief period of a few months' time, is due to the almost total lack of that technical knowledge and those sailorly qualities without the possession of which Russia may as well give up once and for all her dream of becoming a great naval power.

PERFORMANCE OF FRENCH AND AMERICAN LOCOMOTIVES COMPARED.

In view of the statements which appeared in the European press a few years ago, to the effect that the American-built locomotives imported into Europe had proved to be extravagant in consumption of fuel and oil, the report of recent tests of locomotive performance on French state railroads will be found to be satisfactory, and largely contradictory of these statements. In the current issue of the SUPPLEMENT we publish an article from one of our French correspondents, giving the gist of the results obtained. The comparison is of value, because the conditions under which it was made were such as to render the results obtained reliable; although some allowance must be made for the fact that the perfect acquaintance of the engineers with the French type of locomotives, and their unfamiliarity with the imported American type, must, at least in the earlier days of their service, have militated somewhat against the latter. The comparison was made between two French engines, one of which was of the celebrated De Glehn compound type, and two American locomotives, one of the simple type, and the other the Vauclain four-cylinder compound. The coal consumption per horse-power, contrary to the generally-accepted opinion, is shown by these tests to be about the same for the American as for the foreign locomotives, the American compound burning 3.3 pounds of coal per horse-power per hour as compared with the consumption of 3.24 pounds for the French De Glehn engine, and the consumption of the American simple engine being about the same as that of the French simple engine, the respective figures being 4.45 pounds and 4.40 pounds per horse-power per hour. The criticisms of the American locomotives made by Mr. Nadal, who had charge of the tests, are that they showed a low boiler efficiency; that there was excessive priming; that the steam is not utilized so economically in the cylinders; that while the American piston valves have certain undoubted advantages, they are difficult to keep tight, causing much loss by steam leakage; and that in consequence of less careful construction, the internal resistance of the American locomotive is greater than that of the French type. In a thoughtful discussion of these tests, the Railroad Gazette draws attention to the fact that the French single-expansion engine averaged 575 horse-power, or 85 per cent of the normal power, which is 675 horse-power, while the competing American single-expansion engine did the same work, developing 575 horse-power; but that this is only about 63 per cent of its normal power, and, therefore, it was not working under such economic conditions as its competitor. Regarding the utilization of the steam in the cylinders, Mr. Nadal is of the opinion that the cylinder economy of the American engines would be as good as that of the French engines if, instead of cutting off at 40 to 50 per cent of the stroke, they cut off at 20 to 30 per cent, which is the French practice. He recognizes the fact that the American engine is worked harder, and that it is considered in this country that the saving of fuel should not be made at the expense of ability to haul heavy trains. The American compound developed superior drawbar pull at high speed; for while the De Glehn compound shows a falling off of nearly 50 per cent, as the speed rises from 30 to 60 miles an hour, the reduction in the Vauclain compound is only 21½ per cent.

In an apparatus for ascertaining the effect of pressure on magnetic induction, Mr. F. C. Frisbie uses rings of iron placed in a box of iron having walls 2 inches thick. Resin oil is forced in and pressure applied to the inside by a screw plunger, the pressure obtainable being 18,000 pounds per square inch. Using a steady field it is found that increase of pressure up to 16,000 pounds per square inch increases the magnetic induction by from 0.5 per cent to 3.0 per cent, according to the primary field used. But using steady pressure, it is found, in general, that for an unannealed specimen, increase of field first decreases induction to 1 per cent, and then increases it until it becomes about 1 per cent total increase. When the specimen is annealed, there is the same initial decrease but less pronounced subsequent increase. Besides the above results, it is found that hydrostatic pressure alters the amount of residual magnetism.

THE PROPOSED NEW TRADE-MARK LAW.

BY ARTHUR P. GREELEY, LATE ASSISTANT COMMISSIONER OF PATENTS.

Registration of trade marks under the present trade-mark law of the United States is of no practical value to American owners of trade marks. The law requires a registration fee far in excess of that required in any European country, and the certificate of registration adds nothing to the protection enjoyed by owners of trade marks under the common law doctrine of "unfair competition" without registration. Registration under the present law is of importance only as a prerequisite to registration in foreign countries, and even in this respect the law falls far short of its intended purpose.

The law, instead of providing that all marks which would be held by the courts are entitled to protection under the common law, makes the Commissioner of Patents the sole judge of what shall be registered as a trade mark, without appeal from his decision and without the possibility of mandamus to compel him to register a mark even though it were held by the courts to be a valid trade mark. A section of the law evidently intended to permit the registration of marks for the purpose of enabling their owners to register them abroad and so protect them, is so obscurely worded that it is without effect. With the increase of our foreign trade in manufactured articles and the consequent increase in importance of the protection abroad of the trade marks of our manufacturers and exporters, the rulings of the Patent Office, instead of growing more liberal in the matter of registration, have grown more and more technical and arbitrary, until it has become impossible for either an American or a foreign owner of a trade mark to secure its registration in the form in which it is used even if registration can be secured at all. As a result, foreign owners of trade marks have been deprived of rights to which they were entitled under the provisions of treaties and conventions solemnly entered into by the United States, and American owners of trade marks, instead of being aided in their efforts to secure protection for their trade marks abroad, have been hampered and hindered and even absolutely prevented from securing such protection and compelled to see their trade marks counterfeited in the foreign markets and their trade destroyed without the possibility of redress. It is no uncommon thing for American manufacturers to find that the trade marks which they have made valuable as the distinctive marks of their goods have been not only copied and used by foreign competitors, but have even been registered abroad and thus become the property of such competitors, the possibility of this usurpation of their trade marks being, it is true, due oftentimes to their own neglect, though largely due to the impossibility of securing registration under the present law as construed by the Patent Office, and the consequent impossibility of securing registration abroad.

The rapid development of our foreign trade in manufactures has awakened American manufacturers to the importance of securing relief from the defects of the present trade-mark law. The matter of the revision of the trade-mark law has been before Congress for many years and it is gratifying to everyone interested in the growth of our foreign trade that at last there is an excellent prospect that the relief so long sought will not be long delayed. The Committee on Patents of the House of Representatives, on December 19, 1904, reported, with a recommendation that it pass, a bill introduced by Mr. Bonynge of that committee (H. R. 16,560), which is calculated to make a radical change in the present practice of the Patent Office in the matter of the registration of trade marks and to give, as stated in the Committee's report, "the relief which the owners and users of trade marks are justly asking at the hands of Congress."

This bill has been ably drawn after a full consideration of the defects of the present law, the limitations on the power of Congress under the Constitution, and the necessities and rights of the owners and users of trade marks. The bill is based on the clause of the Constitution which gives to Congress the power to regulate commerce "with foreign nations and among the several States" and is within the lines of the recommendation made by Thomas Jefferson to the Second Congress respecting the protection of what are now known as trade marks. The bill is also within the lines of the recommendations made by the Commission to revise the patent and trade-mark laws, appointed under the act of June 4, 1898, and embodies many of the provisions of the proposed trade-mark bill recommended by me as a member of that Commission, as well as some of the provisions of the bill recommended by the other members of the Commission. The bill in its present form has the approval and support of the American Bar Association, the National Association of Manufacturers, the Patent Law Association of Washington, the New York Bar Association, and, when its provisions are understood, will receive the support, it is believed, of manufacturers and users of trade marks throughout the country.

As stated by the Committee on Patents, the main objects sought to be accomplished by the bill are: "First, to make provision for the registration of trade marks used in interstate commerce, as well as those used in foreign commerce and in commerce with the Indian tribes; second, to provide a procedure which will give uniformity to the laws governing the registration of trade marks; third, to provide additional penalties for the infringement of a registered trade mark; fourth, to reduce the fee required on filing an application for the registration of a trade mark; fifth, to regulate the procedure for the registration of a trade mark governing cases of interfering or conflicting claims to the use of trade marks; sixth, to make our statutes conform to treaty stipulations entered into between the United States and certain other governments."

Stated more in detail, the bill provides for the following advantages to owners of trade marks not enjoyed under the present trade-mark law:

The registration fee is reduced from $25 to $10.

Marks used in interstate commerce are registrable, thus permitting the owner of a trade mark to secure registration here before using his mark in foreign trade, and, having secured registration here, to protect the mark by registration abroad, before actually sending his goods bearing the mark to the foreign markets. This will prove to be of very great advantage to our exporting manufacturers.

All marks which could under the common law be regarded as trade marks are registrable and cannot be refused registration because of including what may be considered non-essential matter. This is of very great importance in permitting trade marks to be registered in the precise form in which they are used instead of in the mutilated form in which they are now permitted to be registered.

All marks which have been in actual use for the past ten years are registrable, thus providing for the protection of marks which even if not strictly trade marks at the date of their adoption, have, by long-continued use, become the recognized distinctive marks of the goods of those who have used them.

The final decision as to whether or not a mark is registrable no longer is to rest with the Commissioner of Patents, but with the Court of Appeals of the District of Columbia, thus insuring stability of the practice.

The registration of trade marks by any other than the real owner is carefully guarded against by providing for the publication of the applications in advance of actual registration, so that the real owner may have an opportunity to oppose the registration.

Foreign owners of trade marks are permitted to register their marks on showing that they are in fact the owners by reason of having registered the marks in their own countries, and without requiring them to show use of their marks in commerce with or within the United States, thus giving effect to treaty agreements.

By reason of these provisions, it will be possible to place on the register practically all trade marks in use in the United States, as very few trade marks are used wholly within any State.

The provisions for the protection of registered trade marks are such as to make registration of great importance aside from the question of their use in foreign trade. Under the provisions of the bill the owner of a registered mark has a right of action in the United States courts against anyone who uses an infringement of it in interstate commerce or in foreign commerce, thus reaching, through the United States courts, all infringers except those who use the infringement in merely local trade. If the infringement is proved, not only may the actual damages be recovered as at common law, but three times the actual damages may be recovered, if, in the opinion of the court, the circumstances warrant such recovery. This will probably prove of material importance in cases of willful and persistent infringements. The bill also provides that in case infringement is proved the owner of the registered mark may compel the infringer to deliver up all labels and receptacles bearing the infringing mark. Another important provision is that in case an owner of a registered trade mark secures an injunction against an infringer in one circuit, he can enforce the injunction anywhere in the United States without the necessity of bringing a separate suit in every circuit into which the infringer may shift his business.

Other features of the bill provide for giving to foreign trade-mark owners all of the rights enjoyed by domestic trade-mark owners, thus giving effect to treaty agreements.

The provision for opposition and cancelation of trade marks protect the rightful owners of trade marks against the registration of their marks by others so that the bill, when it becomes a law, will neither permit protection to be refused to the rightful owners of trade marks nor permit any advantage to be gained by anyone not actually the owner. There is nothing in the bill which interferes with the common law rights of owners of trade marks and the passage of the bill cannot be detrimental to any rights of the public or of owners of trade marks, but, on the contrary, will be of great and lasting benefit, not only to the foreign trade of the United States, but also to domestic trade. No effort should be spared to secure the early passage of the bill.

ENGINEERING NOTES.

The Italian submarine boat "Delfino" is built of steel plates 1.2 inches in thickness. She is cigar-shaped, her length being 78.4 feet and her beam 9.5 feet. Her displacement varies, according to the extent of her submersion, from 95 to 107 tons. Her engines are worked solely by electricity furnished by 300 accumulators. She has three propellers—one aft for movement ahead or astern, and the other two above for the work of submersion and emersion. The little turret is glazed so that a lookout may be maintained when the boat is submerged. Her sole armament consists of two torpedo tubes forward. Her oxygen supply is not sufficient for officers and crew more than twelve in number.

Sanction is being sought in the next session of the British Parliament for the inauguration of a cross-Channel railroad ferry between Dover on the English and Calais on the French coast. The possibility of such a scheme has been raised several times, and on the last occasion when the question was brought forward, a submersible bridge was projected. This idea, however, has been superseded by a more practical proposal—the establishment of a system of railroad ferries such as are in operation in Denmark, across the Carquinez Strait in California, and across Lake Michigan. There are several difficulties which present themselves in connection with the realization of such a project. A strong current of from 3 to 3½ miles runs between the two opposite coasts at this the narrowest part of the English Channel. There is also a rise and fall in the tide varying from 15 feet to 20 feet. The landing stages at each terminus of the French and English railroads would have to be constructed to allow for this great fluctuation, so that the trains might run direct on to the ferries at any stage of the tide.

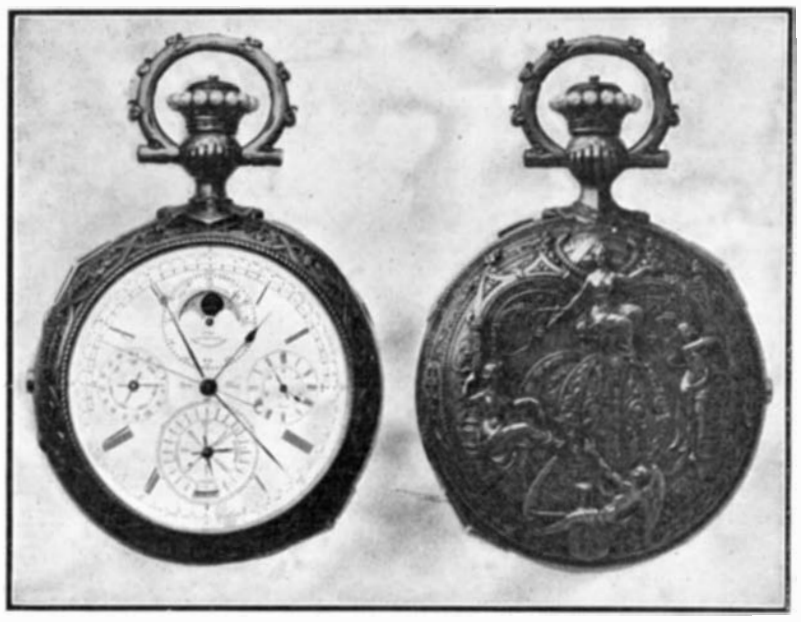
A new invention which will exercise far-reaching results in the manufacture of glass has been devised by the English firm of Messrs. Jules Lang & Son. One of the greatest difficulties in connection with the glass trade, which to a great extent is responsible for the expense entailed in manufacture, is in connection with the pot in which the constituent materials of the glass have to be placed. Owing to the nature of these pots now in vogue, several hours must necessarily elapse before the glass materials in the crucible can be withdrawn from the furnace. By means of this new Lang device, however, the waste of time is obviated. Owing to an ingenious arrangement of its construction, an uninterrupted flow of glass may be obtained, and the manufactured article is equal in clearness and other respects to the product obtained by the present system. Furthermore, the Lang pot can be constructed very cheaply, is easily made, and costs very little to maintain. The pot has capacity for a ton of glass, and is placed in the furnace in such a manner that only two openings are necessary, the mouth and the arch opening. Without any extra fuel consumption, three times as much glass can be manufactured by this pot as by the older method. Furthermore, the product is of a fine or crystal nature, as there are facilities for preventing air entering the pot while the pouring of the molten material is in progress.

A turbine steam yacht containing several new and interesting features has been recently constructed for Sir George Newnes, M. P., by Messrs. Swan, Hunter & Wigham Richardson, of Newcastle-on-Tyne, from the designs of Sir William White, formerly naval constructor to the British Admiralty. The experience gained by the owner during numerous cruises in various parts of the world has led to the incorporation of some novel features in this new vessel, which is of 1,260 tons. A fundamental idea, in the design is the adoption of moderate speed and the utilization of the relatively large dimensions in the best possible accommodation. According to the contract, the maximum speed is to be fifteen knots, and for this speed ample power has been provided. With regard to the turbines, it has been stipulated that there shall be unprecedented economy of coal at cruising speeds, which involves a new departure as compared with other turbine-propelled yachts. Very large bunker capacity has been provided. Although primarily coal is to be used, the bunkers have been built so as to be available for oil fuel, for the use of which the cylindrical boilers can be readily adapted. Electric power is to be used for nearly all auxiliary purposes—steering, cable work, warping, boat hoisting, ventilation, and heating.

A FOUR-THOUSAND-DOLLAR WATCH.

BY PROF. WILLIAM ETZEL, M.A.

Visitors to the World's Fair can bear witness to the high degree of artistic and scientific workmanship attained by French watchmakers. Among these latter the firm L. Leroy & Co. deservedly enjoy special fame still enhanced by the neat miniature watch their representatives at St. Louis recently presented to Miss A. Roosevelt. This same firm has just completed a new masterpiece—already awarded, unfinished as it was, the grand prize at the Paris Exhibition in 1900—and which, though but a watch of 22 lines, can advantageously compete with the perhaps too famous clock of Strasburg. This watch is the achievement of one Mr. Junod who, for the past seven years, has been trying to satisfy therewith the scientific taste of Count A. A. De Carvalho Monteiro, of Lisbon and Rio de Janeiro. The watch has two dials (see cut), the second of which is protected by the case artistically decorated by Mr. Burdin, of Paris. The principal or front dial, besides the ordinary indications of the hours, minutes, and seconds, shows, on four small extra dials, the phases and ages of the moon; the days of the month and of the week (for 400 years); the year (for one century); the months, the seasons, the solstices and the equinoxes; a chronograph indicating the hours, minutes, seconds, and fractions of seconds for scientific observations; a spring development making known the exact moment the watch was last wound up; and indications, by a separate hand, of the mean solar time and of the equation of time.



A REMARKABLE WATCH.

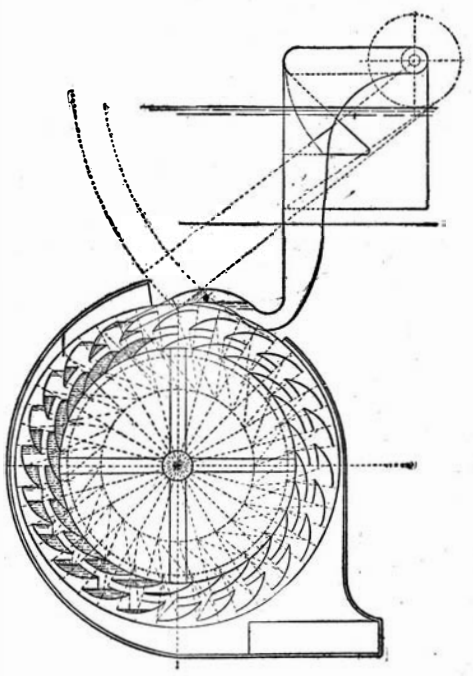
The reverse side (protected by the case) bears a thermometer (Centigrade); a hair hygrometer; an aneroid barometer with corresponding altimeter for heights not exceeding 5,000 meters; 2 dials giving the hours of sunrise and sunset at Lisbon; a ratchet system permitting to rectify the setting without opening the case; the corresponding hour (and hence the longitude) of the different regions of the globe identified with 128 different cities; the firmament.

This latter indication is very interesting. In fact three firmaments are represented, viz., those of Paris, Lisbon, and Rio de Janeiro (of course but one at a time). The stars—tiny golden points—are not thrown upon these disks at random. For the firmament of Paris the constructor simply had to copy one of the numerous French celestial maps at his disposal; but for the firmaments of Lisbon (560 stars) and Rio de Janeiro (611 stars) he marked the co-ordinates D. and R. A. of each star. All the stars of the first three magnitudes are represented, together with a great many of the fourth, and such stars as present some degree of interest, e. g., the Pleiades, Mira Ceti, 61 Cygni, etc. Alcor could not be marked out, notwithstanding the interest attached to it, on account of its proximity to Z (Mizar) Ursa Maj. The horizon is so disposed that in the revolution of the disk, which executes the sidereal diurnal motion, the different non-circumpolar stars rise and set at their respective hours as determined astronomically. The quasi-elliptical form given to the horizon was calculated after an ingenious method of horizontal projection contrived by the constructor. The disk representing the firmament of Rio de Janeiro revolves in a sense inverse of the others, it representing the austral hemisphere with, of course, the magnificent Cross of the South. Naturally the Milky Way is likewise traced, and with remarkable exactness. Such a marvelous watch could but be a repeater, not only of the hours and the quarters, but also of the minutes elapsed since the quarters struck. Thus when the writer examined the works it was 11.19 A. M. On his touching a button, the watch's "rapid little pulse" first beat eleven, then a triple chime indicated a quarter past, and finally a tiny argentine bell struck four, making up 11.19.

Thus far the scientific description of what our readers will certainly agree to call a *chef d'œuvre*. Let us now give a short description thereof from an artistic standpoint. The case represents, by special order, and in beautiful *bas relief*, the Fates with their attributes, and Time, with his scythe and his clepsydra. In the center of these figures and, as it seems, notwithstanding the protestations of the artist, the monogram of the purchaser of the watch. Above the second Fate is the Brazilian globe, and beneath Time the coat of arms of Portugal. To the right—on the rim—is a fleury Roman cross and to the left another similar cross. Around the rim incasing the front dial are the twelve signs of the Zodiac.

The stem-winder is simply the crown of a count, surmounting a helmet, and whose enameled top conceals a very neat mariner's compass.

As was mentioned above, this watch has taken up all the leisure hours of the constructor for the last seven years and has been sold for the really not exorbitant sum of 20,000 francs ($4,000). If other similar ones were ordered by wealthy amateurs of science and art they would neither require so much time nor be unsusceptible of further perfections; for in this case, as in all works of man, the first achievement is a *coup d'essai;* and besides, the astronomical and meteorological observatory of Besançon is constantly taking interest in the chronometric progress of the watchmakers of old Vesuntio.



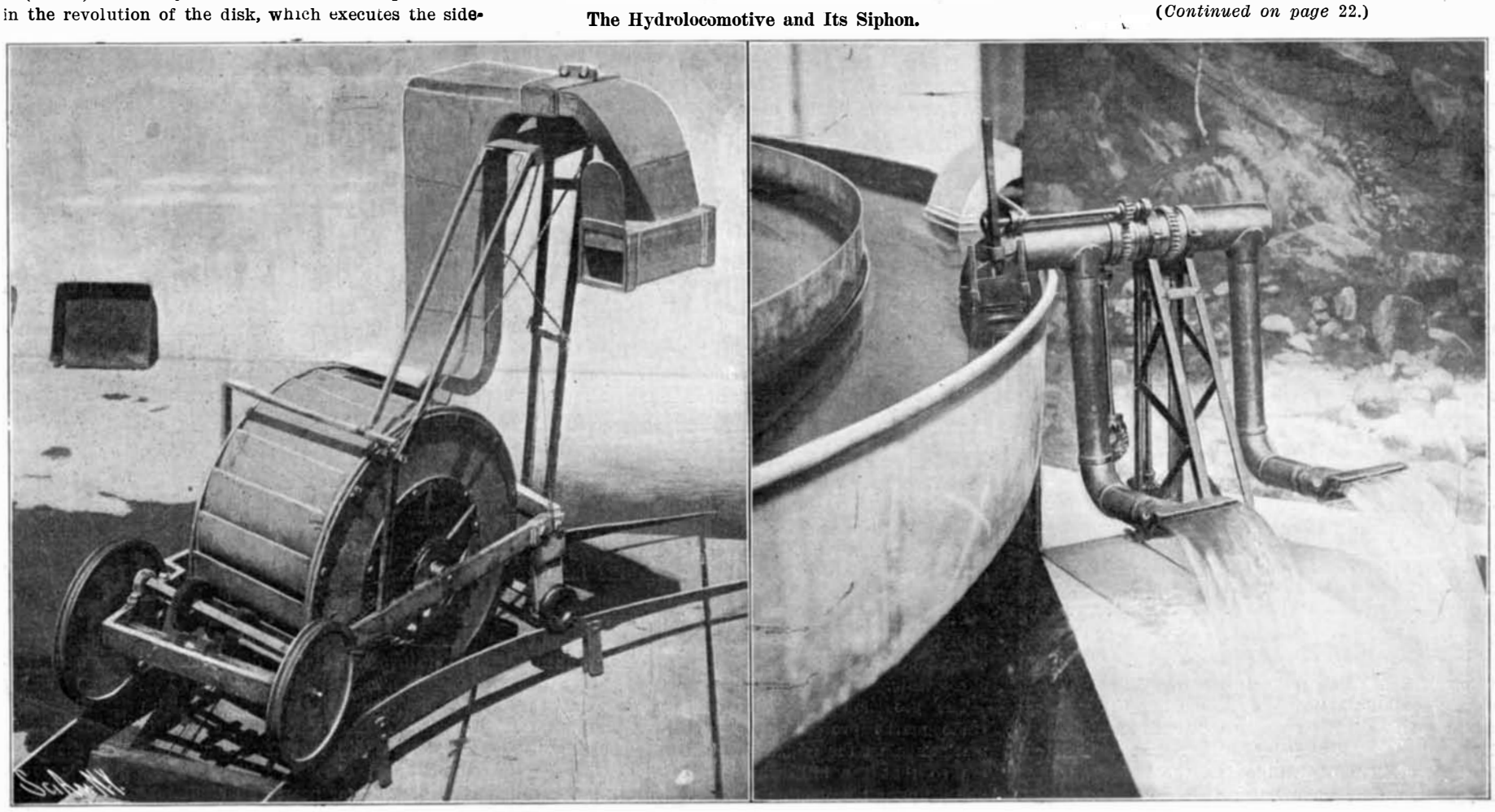
The Hydrolocomotive and Its Siphon.

A NOVEL WATER WHEEL.

BY DR. ALFRED GRADENWITZ.

Overshot water wheels were designed long before the art of machine construction had reached any degree of perfection. But in spite of their simplicity their efficiency has been equaled only by a few complicated and expensive contrivances, such as Francis turbines, Pelton wheels, etc. There are, however, three drawbacks in ordinary overshot wheels: First, the impact of the water, as it rushes in rapidly, cannot be sustained and utilized adequately, the inflow tending to force the water accumulated in the wheel out of its buckets. (It should be borne in mind also that the water jet strikes only the upper edge of the bucket, splashing above the wheel.) Second, the wheel is filled before beginning its revolution up to only a quarter of its entire capacity, as, at the level of the axle, the water necessarily falls out of the buckets.

(*Continued on page* 22.)



The Hydrolocomotive on Its Track

Siphon of the Hydrolocomotive.

A LOCOMOTIVE DRIVEN BY WATER.

THE GROS LIFE-BELT.

BY A. FREDERICK COLLINS.

A new life-saving belt that has been attracting a great deal of attention through the severe ordeals given it by the various life-saving societies in France has sufficient merit to demand the consideration of the authorities here in the States.

It is called the Gros life-belt, and is composed of a series of four small, flat sacs or pouches, circular in shape and connected by a tube inclosed in a gauze vest. When the latter is slipped on under the ordinary vest the belt is brought into a position where two of the pouches rest on either side of the back and the other and opposite pouches rest against the back over the scapulæ.

Inclosed in both ends of the tube are small metallic cylinders, each of which contains a charge of carbide of calcium. With the outer clothing on, the belt is rendered quite invisible, and can be worn by a passenger during the entire voyage without inconvenience and without being noticed by the other passengers.

1. Life-Belt as Worn Under a Vest.

2. Life-Belt Inflated.

3. Life-Belt Inflated to the Fullest Extent.

THE GROS LIFE-BELT.

According to the experiment at La Rochelle, a man who could not swim a stroke, but wearing a Gros life-belt, fell overboard and sank. He immediately arose to the surface and continued to float head and shoulders out of the water and with both arms in the air. The time that elapsed from the instant the water touched the carbide until the sacs or pouches were filled with sufficient gas to keep the man afloat was estimated by means of a stop-watch to be two seconds.

The nature of calcium carbide and the construction of the acetylene lamp are so well understood that it is not deemed necessary to recite the action that takes place when water is added to carbide of calcium. Suffice it to say that acetylene gas is instantly generated.

The first photograph shows the flimsy nature of the vest, which weighs but a few ounces, while the third shows how a minute quantity of water attacking the carbide has filled the pouches with gas, the outer covering of the vest being raised to show the sacs; the latter, though very light in weight, are exceedingly strong, as the second picture indicates. All the tests applied to it by the various representatives of the steamship companies and societies were eminently successful and demonstrated conclusively the wonderful possibilities of the Gros belt as a life-saver.

SNOW CRYSTALS.

BY DAY ALLEN WILLEY.

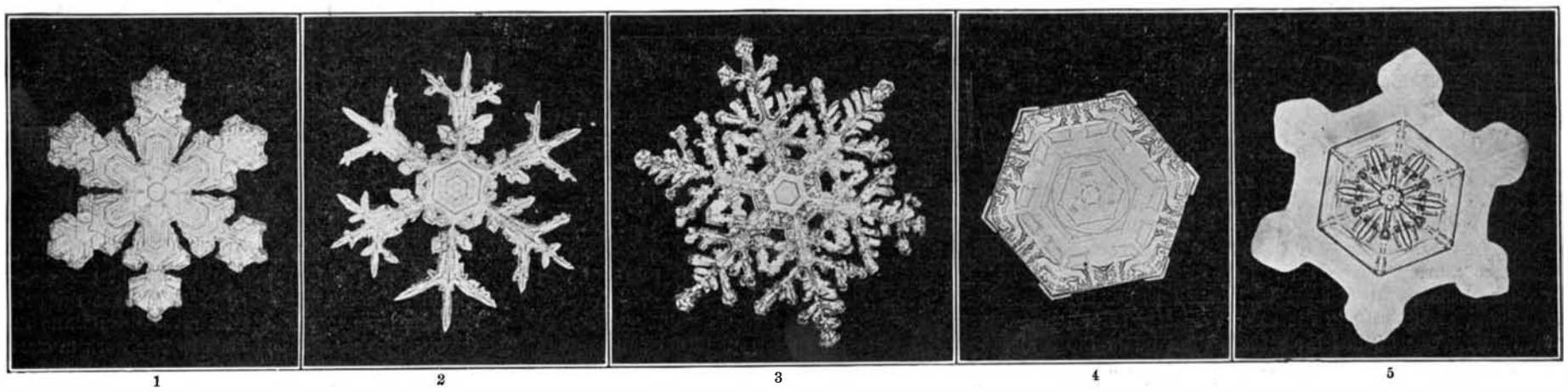
There are few studies as interesting to a lover of nature as that pertaining to the formation of snow. The deposits of snow as we see them directly after a storm, on tree and bush, and on the ground itself, frequently present spectacles which are not only beautiful, but unique. The material adapts itself to so many designs, that it is unnecessary to say that nature frequently plays the part of a sculptor, using snow as a human molder utilizes clay.

If some of the minute particles which compose a snow storm are separated from the rest, and examined with the aid of a microscope, the work of nature is shown in even a more remarkable way; for although the figures represented by the snow crystals are almost numberless in their variety, it can be seen, even with the naked eye in some instances, that a system is employed in their formation which is literally marvelous. To the development of micrography is due the credit of preserving on the negative many of these images, so that they can be studied at leisure without fear of their being destroyed by a change in temperature. From the collections of such views now in existence, much valuable data has been obtained regarding the creation of a snow flake, as the different designs give an idea of the way in which they are formed.

In examining snow crystals, one remarkable fact that strikes the attention of the investigator is the repetition of the hexagon in some form. With very few exceptions, all of the crystals which have thus far been reproduced through the aid of the camera and microscope have either six points or six sides. A comparison of the illustrations accompanying this article proves the statement, despite the fact that such a variety is exhibited in the collection. Taking Fig. 4 for example, the hexagon shape is almost perfectly outlined. In Fig. 5 we find the hexagon, but with the corners elongated, although the tracing of the interior is a perfect hexagon and most beautifully reproduced. Fig. 10 is a further modification, in which it will be noted that at the time the crystal was photographed, others were apparently being formed at each of the six corners. Here is another very artistic combination, in which can be traced a number of these figures, if one follows closely the lines on the surface of what might be called the center piece. Another beautiful design, which is a further variation of Fig. 4, is that of Fig. 1. Here the crystal has been so divided that the corners form by far the largest portions.

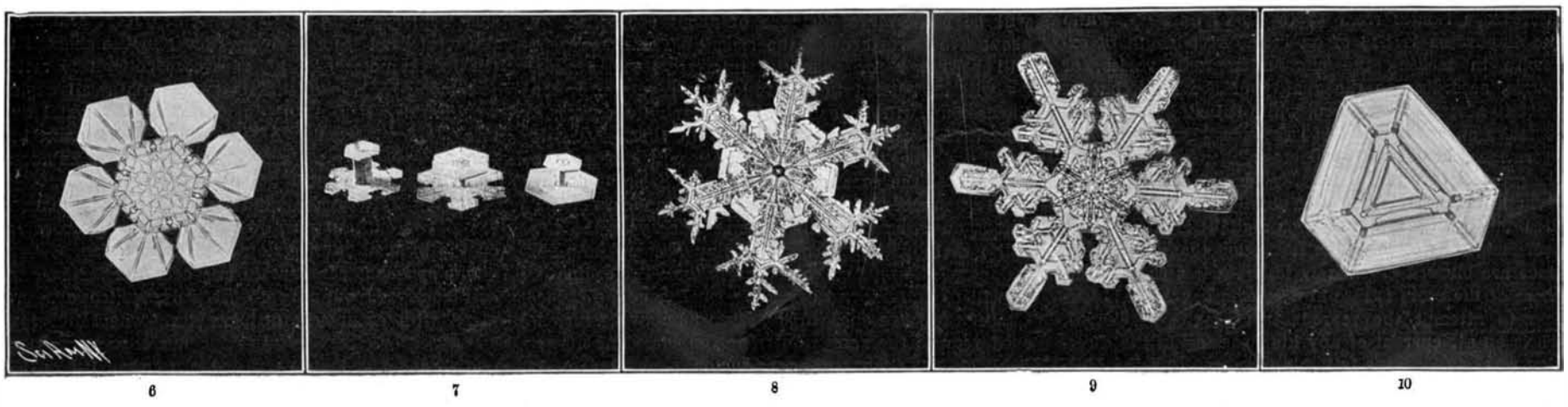
Figs. 2, 3, and 8 form an interesting study of the development of a crystal. As will be noted, the branches which project from the center are six in number, but in Figs. 2 and 3 the nucleus of the formation is a hexagon in miniature, that in Fig. 2 being one of the most delicately and perfectly outlined of the entire series of crystals illustrated. In fact, on it are depicted no less than four clearly defined figures of this kind, while directly in the center are six tiny circles, also arranged in the same shape. Fig. 3 might be called a combination, since apparently it has been formed from coming in contact with another. It represents a single crystal, however, and is merely a freak formation, probably caused by exposure in passing through different strata of clouds.

The series of crystals illustrated are also specially interesting, since they bear such a strong resemblance to familiar objects. Take the three tiny specimens represented by Fig. 7. One might easily believe them to be specimens of inlaid work. The end crystals are also similar to some styles of collar buttons which have recently been manufactured by the jewelers. The photographs of some of the others might be taken for elaborately ornamented needle work, such as center pieces. Fig. 5 is an excellent sample of this work,



1 2 3 4 5

HOW SNOW CRYSTALS APPEAR WHEN SEEN THROUGH A MICROSCOPE.



6 7 8 9 10

THE CURIOUS FORMS ASSUMED BY SNOW CRYSTALS.

while Fig. 4 might be mistaken for a lace handkerchief, although the outlines are more irregular than most of the others. Figs. 1, 6, and 10, however, form designs which the expert in embroidery might select for patterns. In Fig. 6 the groundwork of the corners is so delicate that it bears a remarkable resemblance to fine linen. Probably snow flakes take the form of coral more than that of any other substance. Fig. 3 is an exquisite facsimile of coral branches, although it is not considered by experts in meteorology as among the most perfectly-formed crystals. Fig. 2 is also very similar to the formation referred to. Fig. 8 might be utilized by the cabinet maker who wishes a unique ornament for inlaying the surface of a table or other article of furniture. Some of the designs pressed upon oilcloth bear a similarity to it.

The study of snow crystals and the preservation of their likenesses by means of the photographic negative dates back but comparatively few years, but as already stated, much valuable data has been secured as to their origin. Probably the finest collection of views which has been made is that produced by Mr. W. A. Bentley, of Vermont, who has devoted much of his time during the last twenty-five years to this subject. Fortunately, he is located at a point which is exposed in winter to not only northern and western, but eastern and southern storms, some of them merely local in character, others covering a large area of the country. From his conclusions and the deductions of other students of snow formation, the belief prevails that the most perfectly-formed crystals come from general storms. Strange to say, many of the finest specimens have been secured during so-called blizzards, when the mercury registered an extremely low temperature. The comparatively few triangular shapes which have been obtained by the observers were secured during violent storms of this character. Fig. 10 is an excellent illustration of the triangular crystal, but, as will be noted, it comprises six points in its outlines, being quite similar to the modern toy kite, although its nucleus is triangular. Northern and western storms also produce more perfectly-formed crystals than those from the East and South, possibly because the temperature as a rule is much colder and the air drier, while the eastern or southern storms are apt to be accompanied by dampness in the atmosphere.

The distance of the snow-producing clouds over the earth is also of much importance in the formation of the crystals. Those coming from strata of high clouds are apparently less changed in their passage to the earth than the ones which come from lower strata, although exposure to different atmospheres and different forms of cloud from strata where they have originated frequently alters the shape materially, and sometimes completely changes the original figure. When the delicacy of a snow flake itself is considered, it seems remarkable that the crystals should retain any semblance of their original shape, especially when whirled through the air by the force of such a wind current as produces a blizzard, for the snow flake itself may represent a combination of several crystals. As it is, the collection of crystals which are not broken or partially destroyed from some other cause, is extremely difficult. During an entire winter, not over a dozen storms may be of such a character that the crystals can be secured for illustration and observation. Therefore it is probable that many thousands of designs equally as curious and beautiful have not been illustrated as yet by the collectors, in spite of the extent of the work which has already been accomplished in this line of investigation.

In securing specimens for study and illustration, it is of course necessary to work at a temperature below the freezing point, and usually a room is selected in which one window is open. The room should be on the side of the building exposed to the most frequent storms, so that the snow will fall into the open window, since the particles must be handled as quickly as possible, and then with the utmost delicacy to prevent injury. One method for placing them under the reproducing apparatus is to catch the crystal on a slip of dark paper, which forms the background. After being placed in position, it is pressed flat against the surface by means of a feather. The objective of the microscope ranges from ½ to 2-3 of an inch, while the diaphragm is 1-16 of an inch. The length of exposure in making the photo-micrograph varies, of course, according to the quality of the light, but at least 40 seconds is required, while it may be necessary to make an exposure of 300 seconds. During all the operations, however, the photographer must exercise the greatest care to prevent any current of warmer air from injuring the crystal. The slides should be handled only with gloves, and even a slight breath may be sufficient to so dissolve the formation that its delicate lines are blurred or entirely lost. Unless the temperature of the room is also at a certain degree, it is useless to attempt the reproduction of the specimens, while an air current of any kind passing in the direction of the apparatus is liable to blow away the crystal. The difficulty which attends this study is one of the reasons why such an apparently small number of different shapes of snow formation have been secured. The collection of Mr. Bentley is probably the largest in the country or in the world, yet it does not aggregate over a thousand in all. All of the other collections are much smaller.

Motors for Long Island Railroad.

The Westinghouse Electric and Manufacturing Company has begun work on multiple-control electric motors for 122 cars to be used on the Long Island Railroad, which the Pennsylvania Railroad will operate by electricity.

The 122 cars are to be equipped with four motors of 125 horse-power each. These will haul ordinary trains. As soon as the first order is installed a second contract will be let.

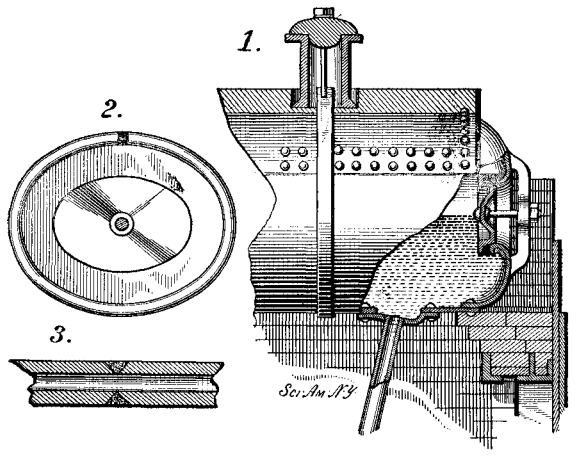
The motor cars will be used to haul trains through the Long Island tunnel, and eventually express trains are to be run from Jersey City to Montauk Point. The short-run trains are to be equipped with motors first.

The Pennsylvania Company will equip the whole length of the Long Island Railroad with copper wires immediately, and the new system will be ready for installation in the spring.

PACKING FOR STEAM-BOILER MANHOLES.

A simple method of packing manholes of steam boilers is submitted to us by Mr. E. P. Larkin, of Hudson, Mass., as shown by the accompanying illustration.

He states that it is not generally known among users of steam boilers that the best and cheapest packing for manhole or handhole is a piece of common lead pipe. For a manhole take ⅜ or ½ inch, bend it around the plate, and cut the ends square and solder together, so as to leave no bunch. With a nail or other tool make two or three small holes on outside, to let out the air when the pipe compresses, and a packing is provided that can be used over and over again. A packing of this kind has been used for fifteen years, and it is found that one lasts from three to five years at an outlay of about 35 or 40 cents. When used up they are worth half price for old lead.



SIMPLE MANHOLE PACKING.

A handhole packing used in this way requires a ¼-inch pipe.

AN ANNUAL ITALIAN AUTOMOBILE CUP RACE.

Automobile matters in Italy are to be greatly stimulated by the efforts of Sig. Vincenzo Florio, who has recently offered a very handsome cup, to be competed for in the annual races at Brescia. Sig. Florio is one of the leading spirits in automobile affairs, and he proposes to make the Brescia week one of the great events of the year. To attain this result he engaged in an active campaign, and there is no doubt that next year the Brescia circuit will rival the Gordon Bennett Cup in interest. The leading event on the programme will now be the Florio Cup. The circuit already had two prizes, the Italian Cup and the one offered by Princess Letitia. In the new programme these latter will not be merged with the Florio Cup, but will be competed for at the same time upon different distances in the circuit. The principal cup race will be run over a distance of about 600 miles, or about five times around the circuit. The other cups will be raced for over the intermediate distances. As will be noticed in the following regulations, the Florio Cup will be competed for annually during a period of seven years, from 1905 to 1912. After it has been won the seventh time it will become the property of the constructor whose car has won it the greatest number of times. In case of an equality of points, an extra race will be run. Each year the cup will remain with the corresponding automobile club. This regulation differs considerably from the ordinary, as will be noticed, and besides, a smaller cup, a reduction of the large one, will be given as actual property each year to the person entering the car. But in the final classification, the constructor alone is to be taken into account. Besides the annual cup, prizes of $600, $250, and $160 will be awarded to the first three cars. These rules have been established on a new basis, and it is judged that a distance of 300 miles is no longer sufficient to estimate the performances of cars which can now make 60 miles an hour on the average. The different cities along the course, Brescia, Cremona, and Mantua, are also to award prizes for the race.

A NOVEL WATER WHEEL.

(*Continued from page* 20.)

Third, the wheel during its revolution loses too early the weight of the water accumulated. Prof. Frank Kirchbach, of Munich, Germany, has tried to obviate these three objectionable features in his "hydrovolve," thus increasing the efficiency of water wheels and opening new fields for the utilization of hydraulic power.

The hydrovolve, as shown in the drawing, has two sets of buckets, spaced apart by a narrow channel and so arranged that the overflow of the inner set of buckets will pour down the channel, filling the outer set of buckets. This arrangement results in half of the rim being loaded so as to impart to the wheel a high starting torque. After the wheel has once commenced its revolution, the amount of impact water can be so increased as to fill the buckets nearly up to the outer edge, when the surplus water instead of being lost always flows inward. The capacity is thus far greater than with overshot wheels, where the buckets should best be filled only to one-third of their capacity lest the water be lost too early.

The operation of the hydrovolve is as follows: First, the live force of the water is projected against the curved inner surfaces of the buckets, the water being deviated downward, and the detrimental back impetus being avoided as in the Pelton wheel. The impact obviously decreases as the peripheral speed augments. The second action is due to the action of gravity, which produces an accelerated motion of the buckets, and to the passage of the water through the overflow channels. There is further a considerable reaction caused by the water leaving the inner bucket over the outer buckets. As the water on leaving the wheel must have given off the whole of its speed, issuing in a direction diametrically opposite to the inflow, all its capacity of work has been absorbed by the wheel. It should be mentioned in this connection that with ordinary water wheels and turbines the foaming water that issues gives evidence of the amount of energy still contained in the outflowing water, while with the hydrovolve, the lower water level in front of the wheel remains practically quiet.

Small hydrovolves (50 centimeters in diameter and 30 centimeters in width) may be connected to the water mains so as to serve for driving sewing machines, ventilating fans, and the like. In the design of the hydrovolve the well-known hydraulic formulæ have to be used. It is claimed that upward of 90 per cent efficiency is derived from the theoretical force as calculated from the diameter of the wheel (H) and the amount of water per second (q), being equal to qH, while a further improvement of the efficiency is derived from the impulse due to the speed of the water which is allowed to act fully.

A novel application of this hydrovolve has been made by its inventor in the design of a locomotive propelled by the impact of flowing water. The hydrolocomotive consists mainly of three parts arranged on a truck; first the syphon, which has connection with a water channel that runs alongside the track; second, one or two hydrovolves; and third, the intermediate gearing, insuring a suitable utilization of the available motive force. A small experimental model which has been used by Prof. Kirchbach on a circular track for making practical measurements is illustrated herewith. This small engine has a weight of 30 kilogrammes (66 pounds), the ratio of the chains and sprocket wheels being so designed that the driving wheels have to perform six revolutions while the water wheel makes one revolution. The work in starting is thus 30 kilogrammes × 6 = 180 kilogrammes (396 pounds), which is done also on a gradient of 1 per cent; the engine may also carry a load of 15 kilogrammes. The output of the syphon is in the present case 2 kilogrammes (4½ pounds) of water per second, the total head from the upper level in the channel to the lowest point of the hydrovolve being 0.65 meter (26 inches). The maximum speed this small engine would be susceptible of on a strictly horizontal and straight track, would be 24 kilometers per hour, but friction and other resistances would have to be ascertained by experiment.

One type of syphon used by Prof. Kirchbach comprises two falling tubes, which feed two hydrovolves on the locomotive, insuring a steadier action.

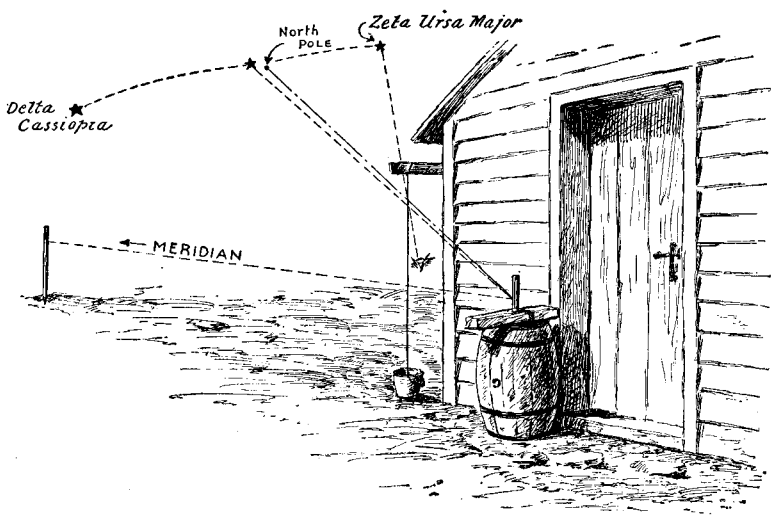
The syphons each contain two openings for forward and backward running respectively, which are provided with accurately fitting gates. The latter may be opened or closed to any desired extent, for starting and stopping and for varying the speed of the device.

DETERMINING THE MERIDIAN WITHOUT INSTRUMENTS.

BY J. A. MACDONALD.

One of the simplest methods of determining the true meridian, and which calls for no mathematical instruments, or knowledge of the celestial sphere, is by observing Delta Cassiopeiæ over the vertical of Polaris. I recently made one of those observations, and found its accuracy by taking two other observations of Polaris at "hour angle" and at elongation. The method is so simple that most surveyors, from its very simplicity, ignore the method. This method is not at all new. Ellicott used it in 1785 in determining the line between Pennsylvania and Ohio. The method has often been described, but seldom or never illustrated. I show in the accompanying illustration the method, which I used a few days ago, and it speaks plainer than words and text can. The dotted line from the peepsight, attached to the block of wood lying on the kerosene barrel, to the pole star Polaris, is continued in the same plane to Delta Cassiopeiæ. When this ray is in perfect alignment, as seen at the peep-sight, with the plumb line, Polaris, and Delta Cassiopeiæ, Polaris is then within 3m. 42s. from the meridian. Watch in hand, the peep-sight is then moved westerly, keeping the star hid by the plumb line. At the expiration of 3m. 42s. the star is on the meridian, and the observer is looking directly north, as shown by the dot and dash line. Zeta Ursa Majoris is also in the meridian, approximately at the same time as Delta Cassiopeiæ, but is too high up to observe through a peep-sight. One eye, however, placed just before the plumb line, as shown in the picture, can range Zeta with Polaris very well. The dotted line shows the visual ray from the eye, going almost vertically through Zeta in the constellation of Ursa Major, and thence curving onward below the Pole to Polaris. Zeta is, however, in alignment with Polaris 42 seconds after Delta. The heavy block will lie unmoved on the cask till morning, when the meridian may be laid out by sighting to a stake some 100 feet to the north, as seen in the picture.

The northwest corner of a building is the best position, as shown in the drawing. The plumb line may be 10 or 12 feet long, and some 4 feet from the corner of the building. The cask may be set about 5 feet south of the plumb line. An ordinary compass sight is the best to screw on the scantling, though a piece of tin, with a slit, will answer.



HOW THE MERIDIAN CAN BE ASCERTAINED WITHOUT ASTRONOMICAL INSTRUMENTS.

WHY BARRELS ARE BROKEN BY ICE EXPANSION.

Correspondents who have studied this question have found that suspending a piece or stick of soft wood in the center of the cask prevents the breakage of the cask when the water is solidly frozen. It is asserted by some that a cask open at one end cannot burst, since the upper layer of ice has a free end to expand, but a correspondent shows this is not conclusive in the set of sketches herewith.

He states: There is a resistance very soon. A barrel of water placed on a flat surface without air circulating under it forms ice first at the open top, then at sides, last at bottom. This difference continues, increasing the thickness at top and angles until there is formed an egg-shaped chamber around the remaining water. The ice is heaviest at top and thinnest at middle of bottom. As the increased pressure caused by expansion of freezing presses against the barrel, the weakest surrounding wall must give. If the bottom with its thin layer of ice is stronger than the top ice, this last will break, relieving the pressure (Fig. 4); but frequently the greater thickness at top resists at the expense of the bottom.

A piece of wood two or three feet long, suspended with lower end at center of barrel, the water under pressure will escape between it and the surrounding ice to top, congealing there in layers, forming an elevation several inches high. This escaping water prevents the wood from becoming tightly fixed in ice, and the increased pressure beneath may cause it to rise several inches through the ice, as seen in Fig. 3.

Fig. 1 shows the first stage of the ice formation. Fig. 2 is the second stage, showing the extra thickness at the top and the beginning of the ice uplift.

It is a well-known fact that water begins to expand while it is seven degrees above its freezing temperature, and the expansion continues as it becomes ice. In the change from water to ice the expansion is about one-ninth, and this amount of space must be provided somewhere. Usually a strong barrel will hold, and the ice will give way at the top, but the use of a stick of timber no doubt is helpful in preventing possible breakage.

The Current Supplement.

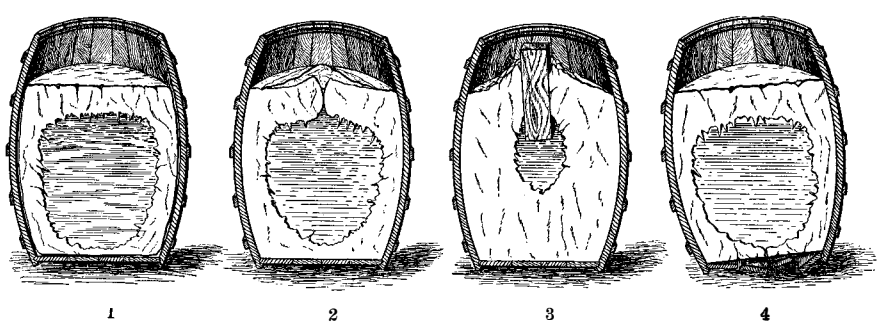
The current SUPPLEMENT, No. 1515, opens with an exhaustive article by Mr. Arthur Gulston on "Ice-breakers and Their Service." The paper is very fully illustrated with photographs of almost every type of ice-breaker now in use. Prof. N. Monroe Hopkins presents his fourth paper on "Experimental Electrochemistry." The present installment describes some novel experiments in electrolytical induction. Mr. William Bateson discourses on "Breeding and Heredity." A new process of testing lubricating oils is described, which depends upon a novel electrical principle. The method consists in measuring the internal resistance of a column of fluid, at the base of which some particles of the oil to be studied are set in motion. The greater the internal friction of the oil to be tested, the greater will be the effect upon the column. Two of the largest French railway companies have been employing American locomotives. M. Daniel Bellet presents an interesting account of the results obtained with these engines. Mr. Israel C. Russell writes on the co-operation of American geographical societies. Another installment of Prof. G. W. Ritchey's interesting paper on the making and testing of optical mirrors appears. The present installment discusses the testing and figuring of paraboloidal mirrors, and testing and figuring convex hyperparaboloidal mirrors. "The Influence of Boric Acid and Borax on Digestion and Health" gives a *resumé* of Dr. Wiley's painstaking investigations.

Another Borelly Comet.

On December 28, Borelly at Marseilles discovered a comet which has been observed by Prof. Kreutz at Kiel, Cohn at Koenigsberg, Hammond at Washington, Seares at Columbian, Mo., Barnard at Yerkes Observatory, and Aitken at Lick Observatory. The last-mentioned astronomer has computed the following ephemeris from observations made on December 31 and January 1:

1905 Jan. 5.5d.	R. A. 1 h., 23 m. 8s.	Dec. — 4° 12′	Light 0.94
1905 Jan. 9.5	R. A. 1 h., 28 m. 52s.	Dec. — 1° 04′	
1905 Jan. 13.5	R. A. 1 h., 34 m. 56s.	Dec. + 1° 59′	
1905 Jan. 17.5	R. A. 1 h., 41 m. 20s.	Dec. + 4° 50′	Light 0.77

The electric underground tube railroad of London has established a unique achievement in the dispatch of thirty-one trains per hour in either direction. This is equivalent to one train in less than every two minutes, which is additionally remarkable when it is remembered that the trains have to be dispatched from one platform. When the railroad was first opened a service of fifteen trains per hour was established. But as the working of the railroad became more familiar the service was accelerated until the present service has been attained. This service is maintained between the hours of 8 and 10 in the morning and from 5 to 7 in the afternoon to cope with the rush of traffic that is set up at those times. It is believed, however, that thirty-one trains per hour marks the limit under the existing conditions, as the time occupied in switching a train from the arrival to the dispatch platforms at the termini cannot be accelerated.



EFFECT OF FREEZING WATER IN AN OPEN BARREL.

Prof. Waldstein's Proposed Excavation of Herculaneum.

Prof. Charles Waldstein, of Cambridge University, England, lectured recently in New York on a plan of his to excavate the city of Herculaneum which, together with Pompeii, succumbed to Vesuvius. It is Prof. Waldstein's plan to have the United States and the principal countries of Europe co-operate in unearthing the ancient town.

The last excavations were undertaken in 1875. To continue work would require a sum of money which no single government would care to appropriate. Indeed, the task may be said to be a rather difficult engineering feat, inasmuch as the modern city of Resina is built upon the ancient site, and must be preserved so far as possible.

Prof. Waldstein has formulated a plan whereby the work is to be supervised by national committees in each country, the honorary head of each to be the ruler of the particular country. An international committee is to be headed by the King of Italy, and an international staff is to be appointed with whom the Italian archæologists into whose hands the work will be intrusted are to consult.

That the execution of a plan such as Prof. Waldstein proposes would mean the acquisition of priceless archæological treasures can hardly be doubted. Herculaneum, historically considered, is a far more interesting city than Pompeii. Pompeii was but a provincial town inhabited by Romans of the lower class. Herculaneum, on the other hand, was a city of villas, and its inhabitants were the *élite* of the empire. More Greek than Roman in its artistic atmosphere, the city retained its distinctive character up to the time of its destruction and attracted many Greek artists and writers. The finds which were made a quarter of a century ago during the interrupted excavations gave promise of still more important discoveries. "In one house alone," said Prof. Waldstein, "sixty-five copies of one work on Epicurean philosophy were discovered. . . . May we not find in Herculaneum the lost books of Livy, the great lost dramatist, and throw new light on the early history of Christianity?"

Herculaneum was more fortunate, from the archæological standpoint, than Pompeii. Unlike the latter city, it was not covered with ashes which destroyed everything that was perishable, but was overwhelmed to a depth of 80 feet with a kind of soft mud which has acted as an excellent preservative of wood, papyri, statuary, and other objects. After the eruption of Vesuvius many Pompeians returned to their homes and hastily removed whatever valuables had escaped the eruption. The depth to which Herculaneum was buried prevented a similar procedure by its people. For that reason the excavation of Herculaneum means the revelation of a Roman city exactly as it was left in the highest state of its development.

Legal Life of a Railroad Ticket.

A decision as to the life of a railroad ticket, which is attracting considerable attention, has been rendered in favor of the Southern Pacific Company by the Civil Court of Appeals at San Antonio, Tex. The court has decided that a railroad ticket which is not used within a reasonable time after issuance, is barred by the statute of limitation. The case arose out of the sale of a ticket by the Southern Pacific on April 29, 1885. The ticket was for a trip from Houston to San Antonio. The man who bought it died without using it. Fifteen years later it was sold. Late in 1899 it was offered to a Southern Pacific conductor. The latter refused to accept it and the man refusing to pay his fare was ejected. There was nothing irregular in the ticket or in its purpose and transfer. In deciding against the man in his damage suit for ejectment, the court holds that "it was never contemplated that the ticket should be held for nearly half of an average lifetime before it was presented for the purpose for which it was purchased. The ticket held by the appellant could not occupy any better position as to the statute of limitation than a promissory note payable on demand."—The Railway and Engineering Review.

At New Rochelle, N. Y., on October 8, Henry A. Gouge, a well-known sanitary engineer and inventor, died, aged 76 years. He was the inventor of one of the earliest safety car heaters, the device bearing his name, and this was in service on the New York Central Railroad until a short time ago. He was also the inventor of a system of ventilating public school houses and other public buildings. He was born at Hartford, Conn., and had lived at New Rochelle over 25 years.

AN INTERESTING POWERFUL STEAM DREDGER FOR HARBOR WORK.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The construction of the new docks at Liverpool for the accommodation of the transatlantic liners, combined with the deepening of the navigation channels and the existing basins to facilitate the passage of heavy-draft vessels, has been attended with several engineering difficulties. One of the most predominant problems is the vast amount of dredging that has to be carried out, a by no means easy task, in view of the fact that the bed of the river is composed of sandstone, rock, and clay. To enable this work to be carried out expeditiously and effectively, a more powerful type of dredger has become necessary, and this has recently been carried out in the construction of the vessel "Vulcan" by Messrs. Ferguson Brothers, of Glasgow, which is one of the most powerful of its type that has ever been built.

The "Vulcan," owing to the complex nature of the work that has been undertaken, possesses several interesting features. It is of the center-ladder barge-loading type. The boat measures 207 feet in length; beam, 42 feet; molded depth, 14 feet; and is fitted with triple-expansion engines developing 1,250 I. H. P. and propelled by twin screws.

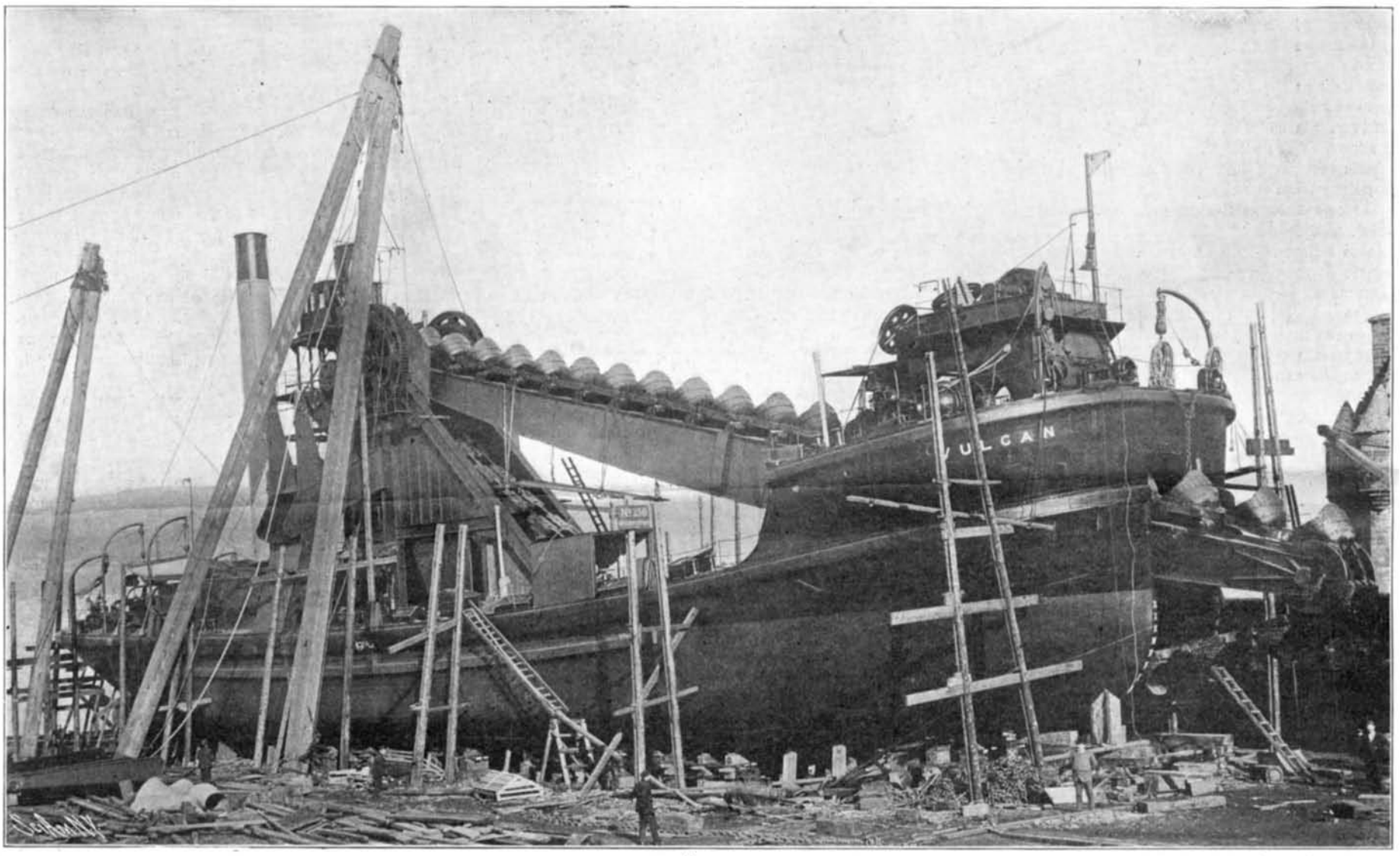
The vessel has been specially designed for carrying out dredging operations of hard material and working close up against the harbor walls. It is capable of cutting its own flotation and of dredging in any depth from its floating level down to 56 feet, the maximum depth, and at which level it has a dredging capacity of 1,000 tons per hour. The bucket ladder is carried out in advance of the hull a sufficient distance to render it possible to dredge close up against the sea walls and piers, when buckets are lowered to a depth of 48 feet.

The vessel is most strongly constructed, and has been built under Lloyd's special survey to class 100 A1. The hull is divided into fourteen watertight compartments. The two sides of the hull, which constitutes the bow well in the fore part of the vessel where the bucket ladder projects, are strongly connected by a raised forecastle, built of strong, heavy girder beams and bracing plates, carried across the vessel above the well. This forecastle is of sufficient height to allow of the bucket ladder being raised when desired for overhauling the lower tumbler, and to insure the sag of the chain of buckets being above the bottom of the vessel. The dredged material is discharged on either side through shoots, and the lifting and lowering operation of the shoots is accomplished by means of an independent engine.

The machinery for carrying out the actual dredging operation is of a particularly massive description, so that the hardest materials can be dealt with by the buckets. There is a two-speed gear provided, so that the dredging can be carried out at varying speeds according to the nature of the bed in which the apparatus is at work. The buckets each have a capacity for 21 cubic feet of material, and the connecting pins for the bucket chain are made of manganese steel.

The bucket ladder is suspended independently of the upper tumbler shaft, which is driven by large double friction spur wheels, and can be adjusted to convey the necessary power to the buckets according to the hardness of the soil in which the dredger is working. The bucket ladder is provided with a hoisting gear of heavy wire rope and tackle working in upper and lower sheave blocks, which are suspended from a crosshead fixed on a box framing structure built into the fore end of the craft. Strong forged side rods connect the lower sheave blocks to the bucket ladder. The wire cable is wound on a large grooved drum gear driven from a double-cylinder engine placed under deck. The gearing between engine and winding barrel is of the sun and planet motion type, controlled by double friction brakes actuated by a compound ladder lever for holding, heaving, or lowering the load as desired, the engine being free to run with or without the load. The deck is also provided with a large steam derrick, for overhauling the buckets and links and other general purposes.

The control of the vessel is maintained from a wheelhouse placed at the highest point of the dredger, which is at the top of the main gear framing. The propelling engines of 1,250 I. H. P. are fitted with steam reversing gear, and have auxiliaries of the latest design. Steam is generated in two cylindrical multitubular boilers. Aft of the bucket ladder are compartments for coal storage and feed tanks, for which there is a capacity of 100 tons and 50 tons respectively. The vessel has a speed of 8½ knots, which is half a knot above the contracted speed.



THE POWERFUL STEAM DREDGER "VULCAN" IN DRYDOCK.

The first unit of the central station of the Mond Gas Power and Heating Company, at Dudley Port in Staffordshire, from which producer gas at a nominal price is to be generated and supplied for manufacturing purposes over an area of 120 square miles, is completed. The whole installation comprises four units, each consisting of eight producers. Each producer is capable of gasifying one ton of fuel per hour throughout the day and night continuously. Steam is raised by vertical boilers arranged for burning small coal with forced draft, and also by gas. The pipes for supplying the gas from the generating station to the various industrial centers have been laid, and are mostly of the Mephan-Ferguson steel locking type. Operations will soon be commenced, and it is anticipated that the scheme will prove of vast utility to the manufactories, as the low price at which the gas will be supplied will render it cheaper than any other system of generating power.

THE INVESTMENT, SIEGE, AND CAPTURE OF PORT ARTHUR.

BY RICHARD BARRY, SPECIAL CORRESPONDENT AT PORT ARTHUR.

In all the long history of military exploits, there is not one that can compare, in point of difficulties surmounted, with the reduction of Port Arthur. That this fortress should have been taken by assault entitles the Japanese operations to rank with the finest work done by any army in any age; that it should have been taken in five months from the day on which the investment was completed (the day on which the Russians were driven into their permanent works) is an exploit which has never been approached. For, mark you, Port Arthur's defenses had been laid out on the most approved and up-to-date theories. Nature, moreover, has cast the topographical features of the place on lines that are admirably suited to defense. The harbor is surrounded by two approximately concentric ranges of hills, the crests of which are broken by a series of successive conical elevations. The engineers took the suggestion thus offered, and ran two concentric lines of fortifications around the city, building massive masonry forts on the highest summits, and connecting them by continuous defensive works. The inner line of the forts lay at an average distance of one mile from the city, and constituted the main line of permanent defense; the outer line, at an average distance of a mile and a half from Port Arthur. Beyond these again were the semi-permanent defenses. The positions of the various forts were chosen in such a relation to each other, that they were mutually supporting—that is to say, if any one were captured by the enemy, it could not be held because it was dominated by the fire from the neighboring forts; and, indeed, it often happened that the Japanese seized positions from which they were driven in this way.

In the majority of cases the slope of the hills was very steep, and what was even worse for the Japanese, smooth and free from cover; so that if an attempt were made to rush the works, a charge would have to be made over a broad, steep glacis, swept by the shrapnel, machine gun, and rifle fire of the defenders. Once across the danger zone, the attack was confronted by the massive masonry parapets of the fort, over which the survivors, cut down to a mere handful, would be powerless to force an entrance.

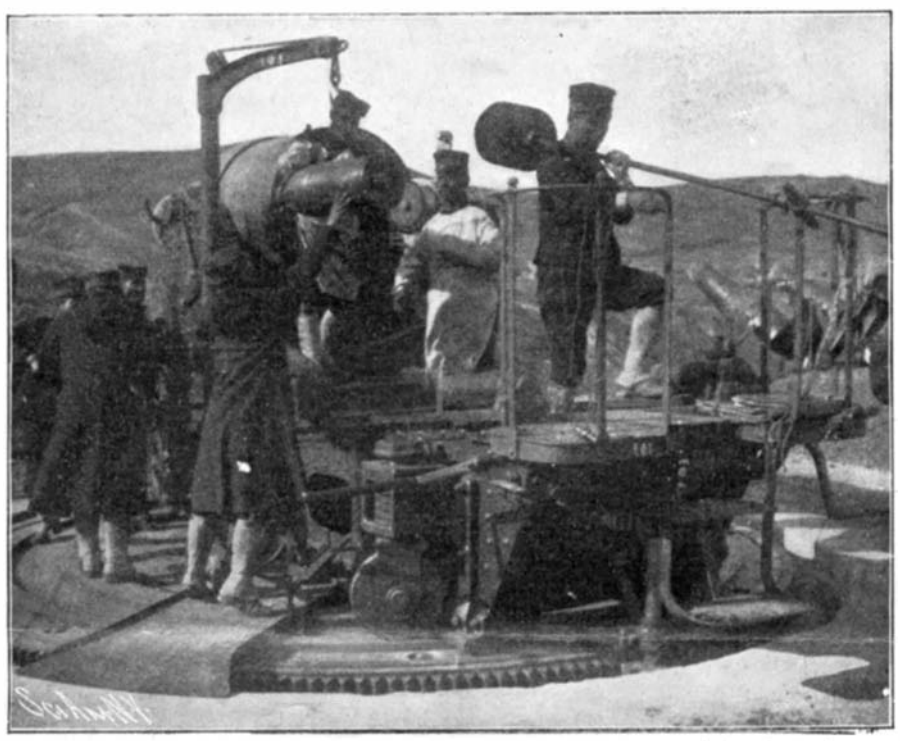
The defense of Port Arthur, however, did not stop at the outer line of fortifications, but extended no less than eighteen miles to the northward, to a point where the peninsula on which Port Arthur is situated narrows to a width of three miles. Here a range of conical hills, not unlike some of those at Port Arthur, reaches from sea to sea; and these had been ringed with intrenchments for troops and masked (or hidden) emplacements for artillery. Between Nanshan and Port Arthur the Russians had built four more

Four men were needed to lift the shell and carry it to the loading crane.

Carrying the 11-inch Shell to the Mortar.

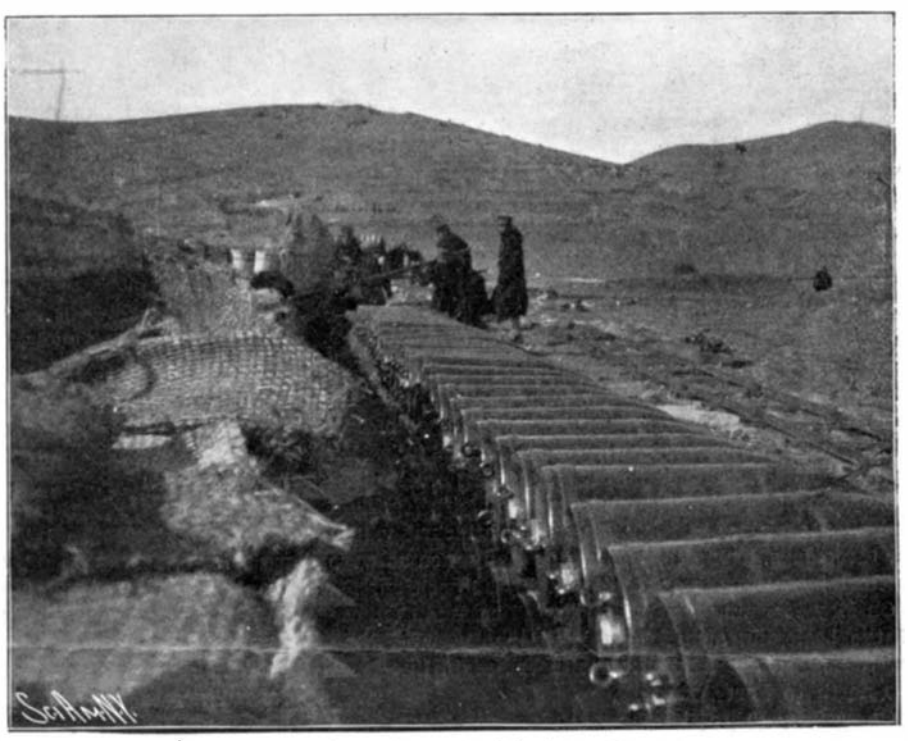
The powder was kept in a bomb-proof cellar and was carried to the gun in a huge case strapped to a man's back.

Up With the Powder.



The swabber departs with his swab, and the chief gunner assists the shell to the breech.

The Shell is Lifted to the Breech by a Crane.

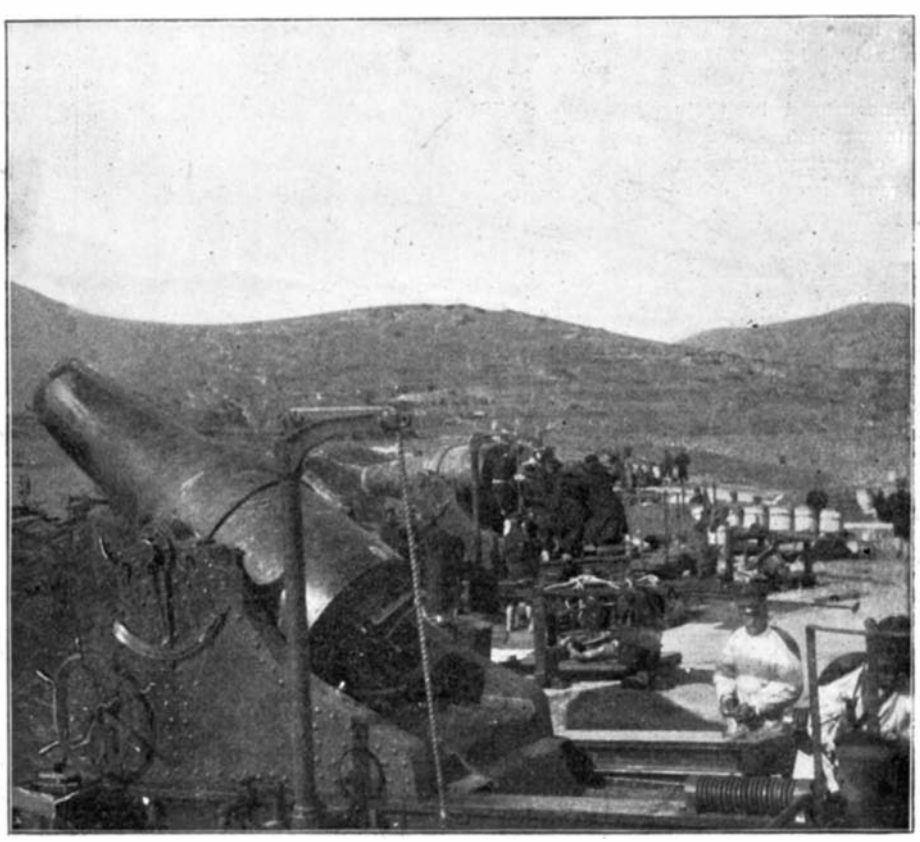


Protected by an embankment of cement-barrels filled with shale from all but a plunging fire, these 11-inch shells lay in the open in rows of one hundred. Each shell weighs 500 pounds.

An Open Caisson of Shells.

The mortars, their mounts, and the materials for the concrete emplacements, were all brought to the site of the batteries over a narrow-gage road, which was under fire for two months.

Bringing Up the Shell Over the Narrow-Gage Road by Hand.



This picture was taken under fire on October 28 at a distance of 2,000 meters from the Russian batteries and 4,000 meters from the citadel of Port Arthur. The nearest gun is loaded, trained and elevated, ready for firing.

A Battery of 11-Inch Mortars.

Photos. by Richard Barry, Special Correspondent at Port Arthur.

THE BOMBARDMENT OF PORT ARTHUR.

Photos. copyrighted 1905 by Munn & Co.

lines of intrenchments, reaching from sea to sea, all very strong and admirably suited for defense. Now it must be borne in mind that all this wonderful network of fortifications, strong by nature of the ground, strong by virtue of the great skill and care with which it had been built, was distinguished from all other previous defensive works by the fact that in this fortress, for the first time, were utilized all those terrible agencies of war, which the rapid advance of science in the past quarter of a century has rendered available. Among these we may mention rapid-fire guns, machine guns, smokeless powder, artillery of high velocity and great range, high explosive shells, the magazine rifle, the telescopic sight giving marvelous accuracy of fire, the range-finder giving instantaneously the exact distance of the enemy, the searchlight, the telegraph and the telephone, starlight bombs, barbed-wire entanglements, and a dozen other inventions, all of which were deemed sufficient, when applied to such stupendous fortifications as those of Port Arthur, to render them absolutely impregnable.

The Russians believed them to be so—certainly the indomitable Stoessel did. And well he might; for there was no record in history of any race of fighters, at least in modern times, that could face such death-dealing weapons, and not melt away so swiftly before their fury as to be swept away in defeat.

But a new type of fighter has arisen, as the sequel was to tell.

On February 8 the first blow fell upon Port Arthur in that famous night attack by the torpedo boats. On February 9 occurred the engagement between the remnant of the Russian fleet and the Japanese fleet under Admiral Togo, which ended in the Russian retreat into the harbor and the closing of Port Arthur by sea.

On May 26 the Japanese Second Army, which had been landed at Petsewo Bay, attacked the first line of defense at Nanshan, eighteen miles north of Port Arthur, and gave an inkling of the mettle of the Japanese troops by capturing the position in a frontal attack. The Japanese pushed on to Port Arthur and there followed, in quick succession, a series of bloody struggles at the successive lines of defense in which the Japanese would not be denied. The fiercest fight took place at the capture of a double height, Kenshan and Weuteughshan, which Stoessel re-attacked vainly for three days, losing three times as many men as were lost originally in the attempt to hold the position.

On May 29 Dalny was occupied, and became the base of the besieging army. A railway runs from Dalny for three miles to a junction with the main line from the north to Port Arthur.

On August 9 to 11 the outlying semi-permanent works Taikushan and Shokushan, lying about three and one-half miles from Port Arthur, were taken, and the Russians driven in to their permanent positions.

The army detailed for the capture of Port Arthur was 60,000 strong; Stoessel at the date of the battle of Nanshan probably had 35,000 men.

Encouraged by their uninterrupted success in capturing Russian intrenchments by dashing frontal attack, the Japanese, particularly after their brilliant success of August 9 to 11, believed that they could storm the main defenses in like manner. They hurled themselves against the Russian right center in a furious attack upon the line of forts stretching from the railway around the easterly side of the town to the sea. For seven days they battled furiously. But the wave of conquest that had flowed over four lines of defense, broke utterly against the fifth; and after a continuous struggle, carried on day and night, beneath sunlight, moon, and searchlight, they retired completely baffled, with an awful casualty list of 25,000 men.

On September 1 the Japanese, finding that they could not take Port Arthur by assault, settled down to reduce it by an engineering siege. This latter was carried on by means of "sapping and mining," supported by heavy bombardment, its object being to shake the defense by terrific artillery fire, blow up the parapets and other defenses by subterranean mines, and capture the fortress by fierce assaults delivered from concealed trenches close to the fortifications. Sapping and mining may be described as a method of attack by tunneling. The Japanese found that they could not get into the forts by a rush above ground, so they determined to burrow in below ground. The main attack was directed against the line of forts to the east of the city, or the Russian right center. The first operation was to cut a deep trench, not less than six feet in depth and a dozen or more feet in width, roughly parallel with the line of forts, and at a distance of about 1,000 yards therefrom. From this trench three lines of zigzag trenches were dug in the direction of the principal forts of Erlung, Keekwan, and Panlung. These trenches were about six feet deep (deep enough to hide the sappers from view) and eight feet wide (wide enough to allow the troops to march to the assault four abreast). The zigzag consisted of an alternate approach and parallel, the former extending diagonally toward the fortification, the latter parallel with it. The angle of the diagonal approaches was always carefully mapped out by the engineers, and was so laid with reference to the enemy's forts, that it could neither be seen nor reached by shell fire. The digging was done chiefly at night, and the soil was carried back through the excavated trenches in gabions and on stretchers, and dumped out of sight of the enemy. As the parallels were advanced across the valley or level spaces, they were roofed at intervals, with planks covered with soil and grass, so that as the Russians looked out toward the ravine in which the army was supposed to be encamped, there was nothing to indicate that the enemy was cutting a series of covered roadways, right up to the base of the forts themselves. Of course in many cases the trenches were located, and desperate night sorties were made in the endeavor to break up the work. But it went remorselessly forward. When the foot of the fortified slopes was reached, a second great parallel, extending around the whole face of the fortified eastern front, was cut—this latter for the purpose of assembling the troops for the final dash upon the forts. From this parallel the Japanese cut tunnels straight through the hills until they found themselves immediately below the massive parapets of such forts as they wished to reach. Here cross tunnels were cut, parallel with the walls and immediately below them, in which tons of dynamite were placed and the wires laid ready for the great explosion—much of this being done, it must be remembered, entirely unknown to the Russians, secure in their great fortifications overhead. The work of the sappers and miners was now complete.

In the rear a battery of mortars may be seen; Russian shells are falling not two hundred yards away.

Back for More Powder.

It must not be supposed that while this slow work was being carried on, the garrison at Port Arthur, or the city itself, or even the fleet in the harbor, was being left in peace, or had any respite from the harassments of the siege. For as soon as the investment was complete, the Japanese erected hidden batteries in various carefully-selected positions, until they had no less than 300 guns trained against the city. All the furious assaults that failed so disastrously were preceded by bombardments, the like of which had never been witnessed in the history of the world. These batteries consisted of regular siege guns of from 5 inches to 6 inches caliber, a large number of naval guns of 4.7-inch and 6-inch caliber, and the regular field ordnance of the three divisions and two independent brigades composing the Third Imperial Army.

By far the most formidable pieces used in the bombardment, however, were the powerful 11-inch mortars, which were mounted in batteries of from two to four in various positions behind the ranges of hills which effectually screened the Japanese from Russian observation. The pieces are the Japanese latest type of coast-defense mortars, such as are used along the Straits of Shimoneseki and about the Bay of Yezo. They were brought by sea to Dalny, carried by railroad for a distance of fifteen miles to the end of the track, and from thence were hauled by hand over special tracks laid direct to the emplacements. In some cases, indeed, the guns were dragged on rollers through the sand, as many as 800 men being required to haul a single mortar; for the mortar barrels, without the carriage, weigh eight tons apiece. This task was accomplished under fire, in rainy weather, and in the night, to the accompaniment of bursting shrapnel and other discouragements which would have daunted a less dauntless race. Even when the selected site of the batteries was reached, every one of the eighteen mortars had to be placed upon a concrete foundation eight feet in depth and eighteen feet in diameter. In each case an excavation had to be dug, the concrete prepared and rammed into place, the heavy foundation plates, traversing racks, and the massive gun carriage, weighing much more than the gun itself, erected and adjusted, and the whole of the heavy and costly piece put together with the greatest nicety. All through the long months in which the sappers and miners were cutting their trenches, the engineers were putting in place these huge mortars, which were not originally intended, be it remembered, for such field operations as these; but were designed for permanent sea-coast fortifications around the harbors of Japan.

The mortar itself has a bore of 28 centimeters, or 11 inches. The shells are designed to burst on contact. They are loaded with high explosive designed by the Japanese Dr. Shimose, and corresponding in its terrific bursting effects to the English lyddite, the French melinite, and our own maximite. Each shell weighs 500 pounds. Its cost is $175, and the cost of each discharge, including that of the impelling power, is about $400. During the heavy bombardments, each gun was fired once every eight minutes, and as the grand bombardments lasted in every case about four hours, the cost for these mortar batteries alone must have been over $200,000, and for the whole of the batteries, including naval guns, machine guns, etc., the cost of each bombardment was approximately half a million dollars. The 11-inch mortar has a maximum range, with a moderate degree of elevation, of seven or eight miles; but as none of these batteries were more than three miles distant from the point of attack, they were fired at angles of as great as sixty degrees, the huge shells hurtling high into the heavens, passing over two ranges of hills, and falling like thunderbolts out of the blue sky, vertically upon the devoted city.

But if the batteries were located behind hills that entirely shut out the object of attack from view, how, it will be asked, could the guns be aimed with such accuracy, to sink, as they did, a whole fleet of warships, one by one? It was in this way: For the attack of

Map of Port Arthur, Showing Position of Forts and Location of the 11-inch Mortar Batteries that Sank the Fleet and Brought About Capitulation of the City.

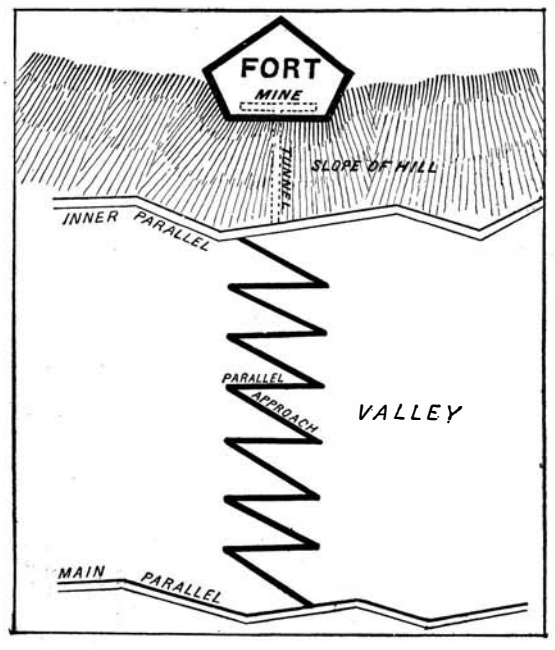


Diagram Showing Method of Attacking Fort by Sapping and Mining. Advance is Made by Open Trenches to Foot of Slope and then by Tunneling.

stationary objects such as forts, docks, buildings, ships at anchor, etc., the artillery officers were provided with a map of the whole area of bombardment, which was laid out in squares, each square having its own number. The Japanese having, at the close of the Chinese war, been in possession of Port Arthur themselves, and having possessed during the past few years an excellent bureau of intelligence, knew the exact location of every building or object of importance in and around the city. Consequently, when the artillery officers were directed to attack a building in a certain square, or a particular fort, they knew exactly what angle of elevation to give their gun, and how far to traverse it, so as to cause the shell to fall with mathematical accuracy upon the particular object to be hit.

The attack upon the warships, however, was another proposition, for they could be, and were, shifted, from time to time. To make sure of hitting them, it was necessary to have some direct line of vision. The Japanese knew that such a line of vision could be obtained from the top of a hill to the west of the city known as 203-Meter Hill—the Russians knew it, too. Hence that awful struggle for possession of this hill, which cost so many thousands of lives. The Japanese won the position. When they had taken it, they placed observers provided with the hyposcope—a telescope that enables the observer to observe the surrounding country without exposing himself above the surrounding parapet—upon the summit, in suitable positions, and held the hill with sufficient force to prevent its being retaken. The batteries were then trained at the individual warships, and the effect of the shells was telephoned from 203-Meter Hill to the various batteries, and the errors corrected, according as they were long, short, or wide, until the huge shells commenced to drop with unerring accuracy down through the decks and out through the bottom of the doomed warships. The ships tried to escape observation by hiding on the outside of the harbor behind the Tiger's Tail hills, and in a cove behind Golden Hill; but there was no escape, and ultimately every ship of the squadron was sunk.

That was the beginning of the end. The 11-inch batteries when directed at the forts tore gaping holes in the parapets, and according to the testimony of Gen. Stoessel, they were simply irresistible. One by one, after furious bombardments, the walls of the great forts were blown up by the explosion of the subterranean mines that had been laid by the sappers and miners, and the Japanese massed in readiness for the attack in the inner parallels, swept in through the wide gaps thus formed, and seized the fortifications, from which, a few months before, they had been swept back in terrible and crushing defeat.

Geology and Geography at the American Association for the Advancement of Science.

BY EDMUND OTIS HOVEY.

Geology and geography together occupied a large share of the attention of the members of the American Association for the Advancement of Science at the third Philadelphia meeting of the Association, which was held at the University of Pennsylvania, December 28 to 31, 1904. Section E, Geology and Geography, of the Association held its regular meeting on December 28, the principal feature of which was the address of the retiring vice-president, Prof. Israel C. Russell, of Michigan University, on "Co-operation Among the Geographic Societies of America." An abstract of this important paper appears in the current SUPPLEMENT. The officers of the section are, vice-president and chairman, Prof. E. A. Smith, of University, Ala.; secretary, E. O. Hovey, of New York city.

The general programme was introduced by Prof. A. P. Brigham, of Colgate University, with a paper on "Early Interpretation of the Physiography of New York State," in which was outlined in an interesting manner the observations made by the early white travelers through the Mohawk Valley and westward, and the descriptions published by President Timothy Dwight, Governor De Witt Clinton, and others. Some of these observations were very keen, especially when we consider that the whole region was heavily forested at that time, and indicate that the idea of the existence of an ancient lake (the "Iroquois Water" of recent writers on the Glacial Geology of New York) is not so new as some have supposed.

In a paper on "The Menace to the Entrance of New York Harbor," Prof. Lewis M. Haupt discussed the projects which have been and are now being carried on by the general government for improving the channels of the Lower Bay. The details of this paper will be found in the SCIENTIFIC AMERICAN of January 7.

Dr. J. W. Spencer, of Washington, D. C., submitted a communication on "The Submarine Great Cañon of the Hudson River," in which he collated the results of soundings which have been made during a period of more than a century, but especially those of the last forty years. Prof. J. D. Dana first recognized the submarine channel of the Hudson as evidence of late continental elevation. Lindenkohl first perceived the cañon-like character of the outer portion of the channel near the border of the continental shelf, the channel suddenly becoming a gorge 2,400 feet deep in the submerged plain. Lindenkohl thought that the cañon was terminated by a bar, but Dr. Spencer has determined that no bar exists, and that the cañon cuts through the edge of the continental bench for about eight miles farther. It then widens to a valley, which can be readily recognized for an additional 12 miles and to a depth of 9,000 feet at a distance of 71 miles from the head of the submarine channel, near Sandy Hook. The cañon is double, the upper part being four miles wide, while the inner, lower, more sinuous portion is less than two miles across. The period of great elevation, amounting to about 9,000 feet, coincides with that of the early Pleistocene. Since that time there has been a subsidence to somewhat below the present level, followed by a re-elevation of 250 feet, as seen by the shallow channels of the continental shelf. The region is now sinking at the rate of two feet a century, and is undergoing other and less important changes.

In a second paper on "The Improbability of Land in the Vicinity of the North Pole," Dr. Spencer said in part:

"When Dr. Nansen discovered the deep Polar Basin, sharply defined by a continental shelf, 300 to 350 miles wide, north of Siberia, with this continuing to Spitzbergen, situated in its very edge, it was proof that no land was to be expected rising out of the basin until the continental shelf on the American side should be reached. The broad Siberian shelf continues even north of Bering Straits, and there are soundings which suggest the location of its approximate border. Alaska encroaches upon this shelf apparently to near its border, thus reducing its breadth to probably 50 miles. Beyond into Beaufort Sea, the Mackenzie River empties by a fjord known to a depth of more than 1,140 feet, and another from behind Bank's Land of 1,836 feet, not far from its own head far within the line of the islands. Among the islands, another of the discovered fjords reaches to more than 2,400 feet.

All of these features prove that the archipelago of high mountains is only a dissected plateau, now sunken and with drowned valleys between the island, which valleys incise the continental shelf in such manner as to indicate that the shelf itself cannot extend far beyond the outer line of the known islands. A sounding about 30 miles north of Grinnell Land, with a depth of 432 feet, further suggests that the edge of the shelf is being approached, for the outer margin of this seems to be limited by a depth of about 300 feet beneath sea level." From these submarine topographic features, which are the very best guide, the author supposes that no important islands exist beyond the line of the known archipelago, and that the deep Polar Basin reaches for 300 to 350 miles from the Pole, approaching the American continental shelf north of Grinnell Land.

The formal session of Section E closed with the reading of eight papers by title in the absence of their authors, and the sessions of the succeeding days of the general convention were given over to the Geological Society of America. The vice-president and chairman for Section E for the next annual meeting of the Association is Prof. William North Rice, of Wesleyan University, Middletown, Conn., and the secretary is Edmund Otis Hovey, of New York city.

Prize for Electrical Inventors.

American inventors have an equal chance with citizens of other countries at a prize of 6,000 francs, offered by the "Association des Industriels de France contre les Accidents du Travail," now organizing to hold a congress in June, 1905, with the object of investigating apparatus which will insure the greater safety of workmen employed on high tension electric conductors. The prize will go to the inventor for the apparatus that will best indicate safely and clearly whether an electric conductor is alive or not. It must be equally applicable to direct and alternating currents of all voltages and must be reliable and incapable of doing damage to itself, the operator, or the distribution system under any circumstances. But his success will mean a very great boon to those men whose work brings them into close proximity to high potential electric wires and machinery. Now that a current of 60,000 volts has become practicable and is much employed for long-distance transmission, this enormous potential being coupled with large quantities of the electric fluid, the danger to the electrician and to workmen who must be employed in caring for such a line and for the apparatus at its ends has become a very serious matter. Danger through carelessness cannot be remedied by any apparatus, perhaps, but such a device as that proposed by the French congress would give timely warning which would save many lives.—Iron Age.

Correspondence.

A Planchette Inquiry.

To the Editor of the SCIENTIFIC AMERICAN:

If you have readers who are interested in experimenting with planchette, I wish they would tell me what means they have found best to make it impossible that the board shall be moved by the fingers of the operator, consciously or otherwise. I can accomplish the purpose by placing upon it two sheets of paper, one of them the transparent sort that is used to protect photographs, and the other a paraffined sheet such as candy is sometimes done up in. By careful selection of the right kinds of paper, I succeed in getting a combination which renders it impossible for the operator to move the planchette; the upper sheet slips on the lower. But it is a troublesome and awkward business, and I hope readers can tell me of something better, or that possibly you can suggest something. I have thought of a ball-bearing device, placing an edge round the board, which shall inclose a number of bullets a trifle larger in diameter than the edge is thick, and laying a smooth board on them. Do you think of anything better? I suppose the subject must have been studied by many people, as nobody can fail to perceive the absolute necessity of cutting out the possibility of any motion coming from the operator's fingers. The amazing results that planchette yields with certain people, the above precaution being taken, assuredly justify taking the necessary pains to cut off all possibility of movement by the operator. G. M. T.

Albany, N. Y., January 2, 1905.

Tuberculosis from Milk.

To the Editor of the SCIENTIFIC AMERICAN:

In the December 24 issue of your valued paper, I notice an article, "Bovine and Human Bacilli Found to be Distinct," which is certainly interesting, as the finding of this German imperial commission, in a way, sustains the stand taken by many scientists of Europe; but at the same time, we ought not overlook that Koch, in his London address, did not maintain that there is a difference in species, but merely that the virus of human consumption is not identical with the virus of bovine perlsucht, and his assertion that these differences between human and bovine tubercle bacilli are not bridged by any connecting links, provoked the strongest opposition; and observations called forth by Koch's assertions have positively demonstrated the existence of intermediary stages; and the opinion is constantly gaining ground, that bovine tubercle bacilli is especially virulent for man, and such an authority as Prof. von Behring, in his Cassel lecture, said: "We shall surely not go wrong when we assume that with a little patience and expert knowledge, we shall be able to make these two varieties absolutely similar again, even in respect to their virulence." Therefore, if we keep in mind the above, the fact that the German imperial commission found in some corpses bovine bacilli in the glands and human bacilli in all other portions of the body—this fact, I say, is significant, and still more significant and important is the fact that three of the cases were young children; and not only is the surmise permissible, but it is pretty sure that they received the bacillus from a diseased cow. This cannot be passed off with a casual advice of carefulness as to using prescribed measures against infection for bovine bacillus. Measures have been tried, measures have been made, and no amount of measures will ever succeed, and especially in America, where about seventy to eighty per cent of our cattle are tuberculous or tubercularly affected. Take the large herds and perform the usual test, and you will be surprised at the number of animals that will react! It is simply frightful—if you stop for a minute to consider this grave danger, this scourge of humanity! Just to think we have tubercular calves, then tubercular cows, tubercular milk, and then tubercular children! What are we doing in this blessed country of ours to offset this great danger? Nothing whatever! The mere killing of an animal here and there has no effect whatever; and in this respect Germany is certainly far ahead of us, as the government in a few parts of the empire has taken up Prof. von Behring's method of immunizing against tuberculosis, and the same has since (1901) proven a great success. Immunize the cattle here, prevent bovine tuberculosis, and you will in time exterminate human tuberculosis.

I hope you will give these few remarks space in your valued paper, as it is a subject worthy of discussion in every way, a subject in which we New Yorkers are especially interested, as here in the city we come daily in contact with this terrible disease, and Prof. von Behring's method ought to be certainly taken up here and tried; and to judge by experiences in Germany, success is assured.

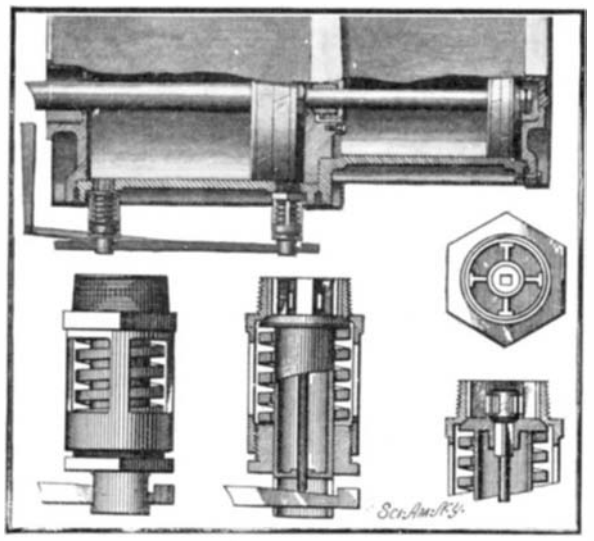
THEODORE D. ADLERMAN, M.D.

New York, December 29, 1904.

Patent Department

CYLINDER-COCK FOR COMPOUND LOCOMOTIVES.

In the accompanying engraving we illustrate an improved cylinder-cock adapted especially for use on cylinders of compound locomotives, to provide means whereby the engineer may open communication between the ends of the cylinder and the atmosphere upon starting, and which will also prevent any undue excess of pressure while running. In the upper figure of the engraving the high-pressure cylinder is shown at the right and the low-pressure cylinder at the left. A cylinder-cock is threaded into each end of the low-pressure cylinder. The details of the cylinder-cock are shown clearly in the lower figures, the one at the left being a side view, and the center figure a partial section. The device comprises a casing formed with large openings inside and closed at the bottom by a plug threaded therein. A valve-seat is formed at the upper end of the casing to receive a valve. A heavy spring normally keeps this valve seated. The valve is formed with a tubular extension, which passes through an opening in the plug and extends below the bottom of the casing. Near the lower end of this extension is a spider, in which is a central opening, which serves as the bearing for the stem of a second smaller valve. The latter closes an opening in the larger valve above referred to. The valve stem is guided at its upper end by radial extensions bearing against the sides of this opening. The smaller valve, as shown in the section at the extreme right of our engraving, operates within a cage extending upward from the face of the larger valve. The top of this cage is closed by a plug. The smaller valve may be opened by means of a rod, which has bearings in the bottom extension of the larger valve, and which is formed with an inclined face engaging the end of the valve stem.

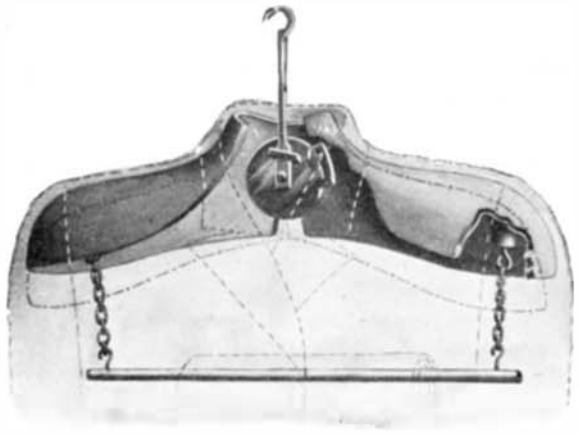


CYLINDER-COCK FOR COMPOUND LOCOMOTIVES.

On account of the lower temperature of the steam in the low-pressure cylinder, it is liable to considerable condensation previous to exhaust while the locomotive is running, and this accumulating is liable to break the intermediate head, or that of the low-pressure cylinder. But with these cylinder-cocks in use, when this accumulation becomes sufficient to create a dangerous pressure, the larger valve is pressed from its seat, permitting escape of the fluid through the side openings in the casing. At the same time the downward movement of this valve carries the seat from the smaller valve and furnishes an additional opening, the escape therefrom being through the spider. When the pressure falls below the tension of the spring, the larger valve is returned to its seat, thus closing both valves. When the engineer in starting desires to release the water from the cylinders, it is only necessary to move the cylinder-cock rod. The operating faces of this rod will then press against the lower ends of the valve stems, raising the smaller valves in their seats, the larger valve remaining in place. This opens communication with the atmosphere through the opening in the larger valve and through the spider. The invention thus provides a compact and effective means both for relieving the cylinder of water, through manual operation by the engineer, and for performing this operation automatically when it accumulates excessively. Mr. Charles B. Alvis, of Las Vegas, New Mexico Ty., is the inventor of the improved cylinder-cock.

IMPROVED GARMENT HANGER.

In the accompanying engraving we illustrate an improved coat and trousers hanger, which is made adjustable to accurately fit any coat, so as to keep it in perfect shape and in the exact position which it will assume when upon the wearer. The hanger, it will be observed, comprises two wings or shoulder pieces, pivoted together. These wings are formed with circular extensions, an extension on one wing fitting between the two on the other; the outer extension is covered with a plate having a central pivot pin passing through all the extensions. This plate is provided with an arc-shaped slot at one side, through which passes a pin secured to the inner extension. The pin, which is threaded, is provided with a thumb nut adapted to lock the parts in any relative position desired. Pivoted on a central extension of the circular plate is a hook, which is limited in its movements by a strap. A bar on which trousers may be hung is suspended below the main hanger frame by chains attached to the shoulder pieces. It will be obvious that a hanger of this character can be so adjusted that it will exactly fit any coat whether having square or drooping shoulders, and will also fit the neck of the garment in such a manner as to prevent any alteration in shape when the coat is left on the hanger any considerable length of time. Thus the original shape of the coat is effectually preserved—an advantage gained which, we believe, has not been attainable with any previous form of coat hanger. The inventor of this improved garment hanger, Mr. John A. Carlson, of 1210 Sterling Place, Brooklyn, N. Y., is a custom cutter, and his experience with the many unsatisfactory garment hangers on the market led him to produce this garment hanger, which he believes will fully meet all requirements.



IMPROVED GARMENT HANGER.

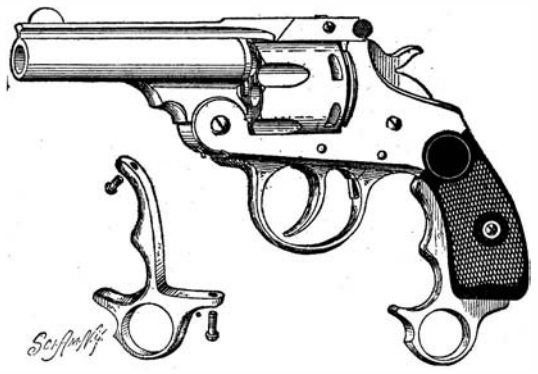
NOVEL ATTACHMENT FOR AUTOMOBILES.

NOVEL ATTACHMENT FOR AUTOMOBILES.

A resident of Canada proposes to humor the skittish horse by attaching life-size dummy horses in front of automobiles, so that they will present the appearance of horse-drawn vehicles. Aside from its office of deceiving timid and high-strung horses, such an attachment would prevent the fear often experienced by the novice, of being pitched over the dashboard of his automobile. The accompanying illustration shows how it is proposed to attach the dummy horse to a motor vehicle. The forward part of the horse, it will be observed, is carried on a roller, mounted on a swivel fork, while the rear is supported by plates attached to the legs and fitted to the forward axle of the vehicle. The body of the horse is made hollow and provides ample storage place for fuel, tools, extra tires, and any other equipment with which it is desired to provide a motor vehicle. Entrance to this tool chest is had through a door in the rear, the tail of the figure serving as the door handle. In the head of the horse a chamber is formed to receive a search light for use at night, and colored lenses at each side serve as eyes for the creature. In its mouth the animal carries an automobile horn. The reins are attached to the lower jaw of the figure, and must be normally held taut, permitting the bulb of the horn to expand and fill with air. When, however, the tension on the lines is relaxed, the jaw, under action of the spring, closes onto the bulb, causing the horn to sound. A patent on this invention has recently been secured by Mr. Henry Hayes, of Fort Thomas, Ontario (Box 620).

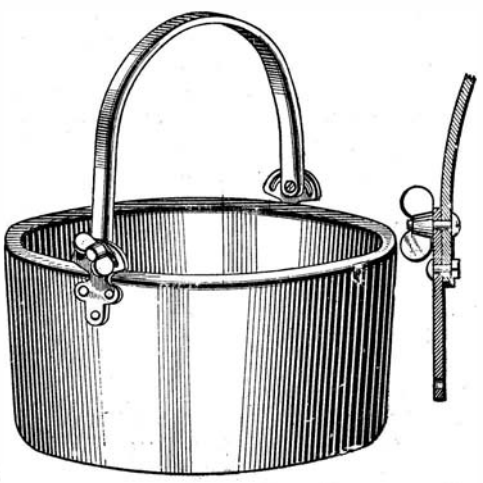
ODDITIES IN INVENTION.

Revolver Grip.—The accompanying engraving illustrates a useful attachment for revolvers which is adapted to provide a firm grip on the weapon. Heretofore, to obtain a strong grip on a revolver, it has been necessary to design the same with a long sweep of the handle, which presents the disadvantages of weight and cumbersomeness. The grip here shown provides a hold for the entire hand, without adding any appreciable amount of weight to the weapon. Its use would prevent the very common occurrence of having a revolver knocked from the hands of the holder, and would preclude the possibility of its being wrenched from the hands by superior strength at just the very moment when it is most desired for defense. The grip is attached to the revolver by means of screws, and it may, therefore, be easily removed at the option of the user. The attachment is manufactured by the Iver Johnson's Arms and Cycle Works, Fitchburg, Mass.



REVOLVER GRIP.

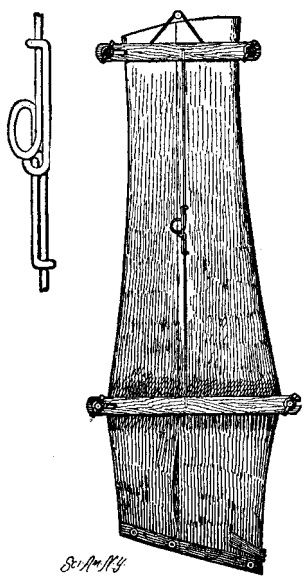
Handle Attachment for Kitchen Utensils.—A useful handle for pots, kettles, and utensils of various kinds is illustrated herewith. It is especially adapted for use on those receptacles which have to be heated and which have a pivoted bail or handle that hangs down in contact with the receptacle while it is being heated. The handle, when in such position, becomes hot very quickly, and it is the object of the invention here shown to remedy such undesirable conditions. As indicated in the engraving, the improved handle is so arranged that it may be secured in any desired position. At opposite sides of the utensil pivot plates are attached to which the ends of the handle are pivoted. These pivot plates are formed with semi-circular slots through which screws on the handle extend. By means of thumb nuts on these screws, the handle may be prevented from turning on its pivots. When the utensil is being heated the handle may be moved to vertical position, and clamped in place by tightening the thumb nut. This will prevent excessive heating. Furthermore, the handle may be secured at any incline desired, as for convenience in pouring out the contents of the vessel. If desired, the handle may be pivoted to the utensil in the usual manner at one end



HANDLE ATTACHMENT FOR KITCHEN UTENSILS.

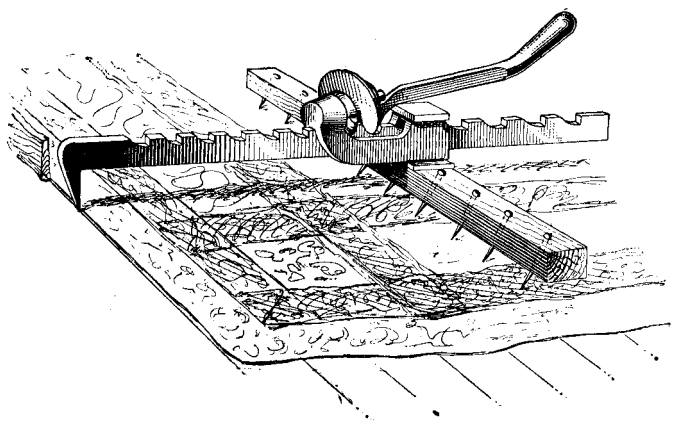
and the pivot plate with its adjusting means used at the other side only. Mr. William Chambers, of 81 Artisan Avenue, Chicago, Ill., is the inventor of this handle attachment.

TROUSERS STRETCHER.—A simple trousers stretcher has recently been invented by Mr. David P. Cooper, of Struthers, Ohio. This stretcher comprises a pair of clamps which are attached securely to the garment and are forced apart by an extensible rod. The invention resides in the novel and effective means for locking the extensible rod in an extended position, and also in the arrangement of the parts which permits of folding the stretcher in a small compass. The clamps above referred to consist of flat wooden bars, held together by bolts which pass through slots therein and are secured by thumb nuts. The extension rod is formed of two sections which, at their outer ends, enter sockets in the wooden bars. Each section at its inner extremity is formed with an eye through which the body of the other section passes. This forms a telescopic connection of the two sections. Adjacent to the end of its inner extremity each section is formed with a loop as illustrated. When it is desired to extend and lock the extensible rod, the loops are drawn together and one is hooked over the other. Owing to the telescopic connection of the sections of the extensible rod, the stretcher may be folded up into a neat and compact parcel not exceeding in length that of the lower clamp bars.



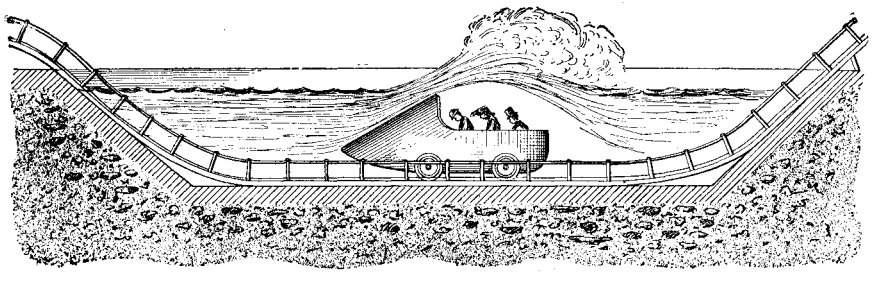
TROUSERS HANGER.

CARPET STRETCHER.—An inventor in Chicago has produced a carpet stretcher of very original type. As will be seen from the illustration, the stretcher comprises a bar provided with a series of projecting pins. The bar is attached to a bracket which slides over a rack formed with a spike at its forward end. Mounted upon a spindle carried by the bracket is a worm adapted to engage the teeth of the rack. In operation the spike on the rack is forced into the floor and then the bar carrying the pins is fed forward by revolving the worm, a handle being provided for the purpose. In this manner the carpet is stretched, being drawn forward by the pins.



CARPET STRETCHER.

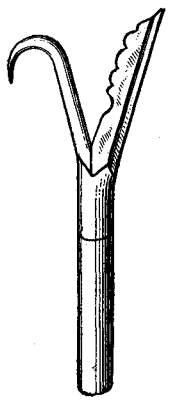
SUBAQUEOUS RAILWAY.—A novel amusement device has recently been devised by a Yankee inventor. As indicated in the illustration, it consists of a boat-shaped car adapted to run down a steep track into and through a body of water with such speed that the shovel nose at the front of a car will throw the water clear over the car, without permitting it to come into contact with the occupants. To prevent derailment of the car, it is provided with double concentric wheels. The larger ones travel on the lower rails, and the smaller ones on the under side of the guide rails above and parallel to the lower rail. The patent from which our information is taken gives no data as to the possible speed of the car or the tremendous amount of work it will have to perform in lifting the large volume of water over itself.



SUBAQUEOUS RAILWAY.

A NOVEL SEAM RIPPER.—A most useful invention for a sewing table is a little instrument called the Seam Ripper.

It is a double-edged knife, with one edge jagged to do the ripping. A hook is formed from the knife handle by which the threads can be pulled out by a slight turn of the wrist. Instead of using four articles to rip with—pin, needle, scissors, and knife—this implement does the entire work.



SEAM RIPPER.

They are a curved needle for picking thread, and also for hem-stitching; a ripper to follow seams to cut open; a jagged knife blade, very sharp, for cutting heavier seams; and an ordinary knife blade.

It is the patented invention of a western woman, and is very useful as a new combined article for this kind of work. Ripping seams, in the making over of old clothes, is a mean and irksome task; and while ripping some baby clothes, the inventor thought out this idea. Making a rude drawing, she gave it to her husband, an expert blacksmith, who constructed a model of same, having sharpened and tempered it.

Brief Notes Concerning Patents.

W. B. Cowles, formerly a lieutenant-commander in the United States navy, is the inventor of a system, which he calls the "long arm," designed to be installed on shipboard. In a moment of peril, all the bulkheads and doors of the boat are closed by the mere touch of a button on the bridge or in the wheel house. Arrangements have been made, it is said, to place this device on a number of vessels now being built for this government. A somewhat similar apparatus is being placed on all the boats of one of the transatlantic lines, and a demonstration of its operation was recently given on one of these craft as she lay at the wharf. Instead of a button, this system is operated by a handle. As this is moved, all the bulkhead doors on board are slowly closed, an alarm having been given first, in order to permit the escape of anyone who happened to be standing or working in the doorway, and to enable workmen and others who might happen to be in the vicinity to get on whichever side of the door would best suit their convenience.

A mercury vapor lamp, somewhat different in its general appearance and construction from those which have been brought out in this country, is being introduced in England by Messrs. Rumney & Rumney, of London. The lamp is the invention of Messrs. C. Orme Bastian and A. E. Salisbury, and is known as the Bastian mercury lamp. A description of the lamp received by an American firm from its London agent reads as follows: In external appearance it resembles the Nernst lamp and is about the same size. The light-producing part consists of an H-shaped glass tube, the lower extremities of which are formed into bulbs having platinum wires fused through the bottom and projecting inward. The tube, which is exhausted of air, contains sufficient mercury to fill the bulbs and just flood the cross-tube, which is slightly curved downward. It is held in a horizontally-pivoted frame and normally hangs so that the legs are vertical. In the metallic cylinder above the globe is a small solenoid connected in series with the mercury in the tube, the current entering and leaving the latter through the platinum wires already mentioned. When the switch is closed, the solenoid attracts an iron armature which tilts the tube. The consequent inclination of the horizontal part of the tube causes the mercury in it to divide, and some of it running into the lower leg and across the gap thus formed, a short arc is left. The arc gradually lengthens, forcing mercury up into the vertical tube until a balance of pressure is obtained, the arc then being about three inches long and giving a vivid light. In order to supply the red rays in which all mercury lamps are deficient, the inventors have fitted a red glow lamp alongside of the tube, which is said to effectually correct the otherwise abnormal color of the light. Even without this addition, the light from this lamp is said to be quite satisfactory for most purposes, the absence of the red rays being noticeable only with the use of a spectrum or when viewing some red substance, when the color appears black. The average life of the lamp is said to be about 3,000 hours, and it is stated that some of them have been in continuous operation for 1,500 hours. It will be noticed that there is no complicated starting device, which is part of some of the lamps of American origin.

Elijah Daniel Fulford, of Utica, N. Y., a man who had a national reputation as the constructor of electrical lines and also as a marksman, died at his home in Utica, N. Y., on October 15. He worked on some of the most important lines in this country, notably some of the transcontinental railroad lines of the southern part of the country. Latterly he was employed by the American Telegraph and Telephone Company in the construction of lines through the Middle West. In this connection he was the originator of a number of important devices used in telegraphy and the construction of lines for this purpose. He developed a reputation as a live-bird marksman in early life, and later entered the field of trap shooting.

In "Looking Backward," by Edward Bellamy, issued some years ago, the author outlines an apparatus by which music of any character to suit the taste of the subscriber may be had by the mere pressing of a button conveniently located in the library or the parlor of a home. This dream is about to be realized, as a company to promote such an invention has been recently organized in Boston, Mass., composed of moneyed men of that city, Philadelphia, and Baltimore. This company has secured the rights to the invention of Thaddeus Cahill, who has been at work on the matter for nearly fifteen years and recently demonstrated its successful operation at Holyoke, Mass. The list of names of those back of the scheme presents a number of the strongest financial men of the cities named, and it is announced that the first service will soon be established in Boston and afterward extended to other cities. One of the officers of the company stated that the apparatus had been examined by Lord Kelvin, when he paid a visit to this country some time ago, and he pronounced it entirely practical. The corporation will be known as the Cahill Teleharmonic Company, the controlling concern being the New England Electric Music Company, which has a capital of $200,000. Mr. Cahill, the inventor, is a graduate of Oberlin College. The difficulty in making an instrument to do this work has heretofore been found in securing the means of accurately registering the great range of vibrations indicating the different musical notes, some being as low as 16 per second and others as high as 8,000. It is planned to have six classes of selections and the annual cost of the subscription will be from $50 upward. The service will become cheaper, it is promised, as the number of subscribers increases. The promoters think that this device will put the piano largely out of business, for the reason that the initial outlay of purchasing a piano is unnecessary.

An interesting paper was read at a recent meeting of the Institution of Naval Architects, which may lead to a very important improvement in the construction of passenger-carrying boats plying the high seas. The paper was read by Herr Otto Schlick, who called the attention of the body to his proposition to increase the period of oscillation of a vessel by means of the gyroscopic action of the flywheel, and at the same time effectively lessen the craft's angle of heel. A large flywheel is set up on board the boat, and revolved at a great speed, and being held in a suitable framework which is somewhat flexible, the wheel and its frame is capable of some lateral movement, to enable it to counteract the motion of the boat. The paper was illustrated by means of models, the conduct of which was pronounced entirely satisfactory by those present, and the gathering included a number of the foremost engineers of England. As soon as any outside influence begins to heel the vessel over in a direction at right angles with its length, the flywheel frame will incline considerably, with the result that moments are produced which not only render the oscillations of the vessel considerably slower, but also very considerably reduce their extent. But these two conditions are exactly the ones which alone are calculated to destroy the rolling motion caused by the waves. A vessel fitted with the appliance would only be subject to insignificant rolling motion. The author and inventor suggested means for the proper regulation and control of the wheel. In the case of a medium-size boat, say six thousand metric tons, it was calculated that a flywheel of 13 feet in diameter, weighing 10 tons, would very materially reduce the amount of oscillation. The vessel having been inclined about four degrees from the upright, will at the next roll reach an angle of only about one degree of inclination, and will have come almost to rest again at the second roll, while the same vessel without the flywheel would probably come to a point of rest after six or seven rolls. This is not the first effort to make use of the gyroscopic action to the same end, for Sir Henry Bessemer spent a great deal of money in the attempt to successfully apply it to the Bessemer saloon, which was to be established on board a steamer, with the view of giving a steady chamber, in which attempt Sir Henry failed completely.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

TELEGRAPH KEY.—J. E. PEARSON, Motor, N. C. In the present patent the invention has reference to telegraphic keys. Mr. Pearson's more particular object being to produce a key which is self-closing—that is to say, a key in which the main-line circuit is normally closed the instant the operator removes his hand from the key-button.

Of Interest to Farmers.

FEED-CONTROLLER.—J. P. WYMER, Ouray, Col. This invention relates to devices for controlling the feed of material to such apparatus as elevators, being more especially applicable to those operating upon fluid or mobile substances, such as liquid or somewhat finely pulverized material. In such elevators, particularly those of the bucket type, a cessation of movement is liable to occur, through accidents to the driving mechanism. When this happens, the boot of the elevator fills up and resists movements of buckets, and must be cleaned before apparatus can be started. To prevent this is the inventor's main object.

TRACTION-TRAIN.—D. BRENNAN, JR., Haverstraw, N. Y. This improvement relates to an organism of elements in an engine and one or more wagons or vehicles, enabling the engine to propel the vehicles in either direction and the entire train to be guided as desired. The control of the train is perfect, the steering being possible either from the end wagon or the engine itself and the train being movable either forward or backward, respectively, by the pushing and pulling actions of the engine.

FEEDER.—C. W. THOMAS, Kent, N. Y. This invention relates more particularly to feeders for threshing-machines adapted for operating upon beans and the like. The feeder will secure a very even rapid feed of the beans to the threshing-cylinder and insure freedom from stones, which would endanger the latter. It will also remove considerable waste material as a preliminary to threshing and will save any of the previously-separated beans without rendering them liable to be broken by the action of the cylinder.

ALARM.—D. B. COATES, Payette, Idaho. This invention relates to alarms and is especially applicable to that class known as "shepherds'" alarms. The inventor's object is to provide an alarm for the use of shepherds which shall periodically detonate a charge of powder for the purpose of scaring away coyotes and other predatory animals and for keeping them at a distance for a time after the explosion.

HAY RAKE AND STACKER.—O. B. MANN, Meeteetse, Wyo. The purpose of the invention is to provide a contrivance so constructed that the rake will gather hay as the machine advances, and when a load is obtained the rake may be raised, so that its load will not trail upon the ground while the machine is being drawn to the stack, and further, when the stack is reached, the rake can be elevated, held in elevated position, and load discharged.

Of General Interest.

GARMENT-HANGER.—AMELIA H. SINSHEIMER, New York, N. Y. The present invention has for its object the provision of an improved hanger more especially designed for supporting ladies' waists and like garments in such a manner that the collar of the garment is properly retained in a position to prevent it from losing its shape. It can be cheaply manufactured.

BAIT-HOLDER AND FISH-DECOY.—V. LE BEAU, New Orleans, La. In this case the object is to provide a transparent holder for live bait, such as small fish, which will serve to expose the bait when suspended in a body of water and allure large fish, so that they may be taken on lines and hooks that are baited and lowered in the water near the decoy or holder.

CORK-PULLER.—T. W. KENNEDY, Hackensack, N. J. The invention has reference to cork-pullers, the inventor's more particular object being to produce a device of this character provided with a box or casing which may be used as a handle for the cork-puller. Cork-pullers are hardly appropriate to be carried in the pocket. The substantially T-shaped form of most cork-pullers renders them difficult and unsatisfactory for carrying on the person. These defects are overcome by this apparatus.

MUSICAL INSTRUMENT.—H. E. HIBSHMAN, Newark, N. J. The invention relates to reed instruments of the mouth-harmonica type, and more particularly to musical instruments such as shown and described in the Letters Patent of the United States formerly granted to Mr. Hibshman. The object is to provide an instrument arranged to require but comparatively little wind and exertion on the part of the operator to properly execute a piece of music with the aid of a perforated note-sheet.

BAG-FASTENER.—S. BJARNASON, Winnipeg, Canada. In this patent the inventor has for his object the provision of a bag-fastener of novel construction which is adapted for the quick and reliable closure of the mouth of a bag or sack, dispensing with the use of cords or the like for such a purpose.

TELLURIAN.—A. HOSKING, Auckland, New Zealand. In this invention the purpose of the inventor is the provision of a new and improved tellurian which is very simple and durable in construction, easily manipulated, and arranged for demonstrating or illustrating the relative motions of the earth and moon around the sun.

CONVEYER-BAND.—F. ABELS, Viersen, Germany. The improvement relates to that kind of conveyer-bands which are formed of metal rods arranged one behind the other. Hitherto the ends of these rods have been connected by chain-links or the like. This way of connecting the rods has always given reason for objection, because squeezing of the conveyers, particularly when running over driving-rolls, has taken place. This band removes the evil.

TOY.—M. L. WICKS, JR., Los Angeles, Cal. The prominent feature of this article is a combined return-ball and cap-snapper or exploder. The inventor employs a hollow ball of rubber or other light durable material, from one side of which a cord projects and at the other side of which is arranged a peculiarly-constructed cap receptacle and striker, so that when the ball is thrown or dropped against the ground or other firm surface the cap will be exploded.

STIRRUP-STRAP.—L. P. WELLMANN, West New York, N. J. One purpose of this invention is to so improve upon the construction shown and described in former Letters Patent for stirrup-straps granted to Mr. Wellmann, that said construction is materially simplified, and means are provided for the ready attachment of a stirrup-iron to a stirrup-strap, and a quick disengagement of the same parts is rendered possible, together with means whereby when the stirrup is not in use it may be disconnected from the lower portion of the strap and connected with and suspended from the upper section of said strap close to the saddle-skirts.

LEVELING-ROD.—W. B. SHROPSHIRE, Pittsburg, Ga. In the present patent the invention has reference to leveling-rods, and more particularly to those which are extensible. The inventor's objects are to provide such a device which may be read directly by the observer at all extensions. In situations where there is limited head room—such as in mines, sewers, and buildings—the improved rod has a great advantage.

DUST-ARRESTER.—G. A. SAGER, Albany, N. Y. The purpose here is to provide a device adapted to extract dust and foreign particles from the air to be fed to pneumatically-operated tools and devices, so that the air upon reaching the operative parts of such tools or devices will be pure, and consequently will not become clogged by foreign matter, as now frequently happens to such an extent as to render the tools or devices inoperative, necessitating time and expense in cleaning.

DISPLAY-CARD HOLDER.—C. C. GOETZ, Natchez, Miss. The holder is especially adapted for use in connection with the selling of textile fabrics from bolts or rolls. While the device is intended primarily as a holder for a display-card, it affords means also for supporting a small bolt of the material which is to be sold, from which bolt or roll small samples of the material may be detached.

SAP-SPOUT AND COVER.—G. H. GRIMM, Rutland, Vt. Mr. Grimm's object is to provide a sap-spout and cover arranged to insure a free flow of the sap from the tree to the bucket; to allow swinging the cover into a rest position and locking it against downward swinging while examining the contents of the bucket or emptying the latter; to protect the contents of the bucket against snow, rain, sleet, leaves, etc., and to allow proper ventilation of the bucket and to hold the cover against swaying in the wind.

EYEGLASS-FASTENING.—F. MICHEL, New York, N. Y. This inventor improves the usual arrangement by providing the stud with a socket and with oppositely-located walls, between which walls the shank of the nose-piece and the spring are placed. A fastening-pin with a square head is passed through the spring and nose-piece shank into the socket in the stud, the square head of the pin lying between the two opposingly-located walls on the stud and the pin being held in place by a key screwed transversely into the stud and engaged in a peculiarly-formed groove in the side of the pin.

LOCKING DEVICE FOR PERMUTATION-LOCKS.—F. DUESTERWALD, New York, N. Y. The invention refers to locks such as are used on safes and like devices in which the combination can be changed at will by the owner of the safe. The object is to provide a device for preventing unauthorized persons from gaining access to the mechanism of the lock with a view of obtaining the combination thereof while the safe is in use and open.

WATER-COOLER.—C. F. CONOVER, New York, N. Y. The intention in this improvement is to provide a cooler arranged to permit automatic charging of the water-cooling receptacle from the water-supply vessel, to insure a proper cooling of the water in the receptacle by the minimum use of ice, and to prevent it from coming in contact with the water in the cooling receptacle.

ANIMAL-TRAP.—L. M. STEELSMITH, Troy, Idaho. The invention has reference to improvements in traps for catching small animals, such as gophers, squirrels, and the like, the object being to provide a trap of simple and inexpensive construction and so arranged as to catch and hold the animal when passing from or into a hole in the ground.

AMUSEMENT DEVICE.—C. B. MCKAY, New York, N. Y. In this case the invention relates to improvements in amusement devices, the object being to produce a device of the character in which passenger-carrying cars are caused to travel a circuitous and undulating track extending through tunnel-like formations, certain parts of which are dark and in which various scenic effects are produced.

Hardware and Tools.

SHEARS.—C. O. BERGMARK, Chisholm, Minn. Mr. Bergmark's invention has reference more especially to shears for cutting sheet-metal. In the form of his improvements the inventor employs a relatively stationary handle provided with a jaw and a frame of special construction, the jaw being formed with a cutting-blade, co-operating with which is a relatively movable cutting-blade mounted in the frame, special devices being also employed for actuating the movable blade through the instrumentality of another and relatively movable handle, also mounted in the frame.

PNEUMATIC HAMMER.—L. J. CLOSSEY, Montpelier, Vt. In this patent the invention has reference to improvements in pneumatic hammers, the object being to provide a hammer of this character that will be simple in construction, positive in its action, and having no parts liable to get out of order. The novelty of Mr. Clossey's invention resides in the peculiar arrangement of valves for controlling the inlet and exhaust of the motive agent.

TOOL-HOLDER.—L. C. WILCOX, Trenton, N. J. The object in this case is to provide details of construction for a holder that will reliably hold a straight cutting-tool disposed at a proper angle to the material when the holder is placed in the tool-post of a lathe and held therein by the set-bolt carried by the post or when the holder is placed in the yoke-clamp of a planer, shaper or slotting-machine and is therein clamped by adjustment of nuts on the bolts of the clamp, whereby the cutting-tool is held from displacement without requiring special set-screws for the holder that take up room and are ineffective in use.

NUT-LOCK.—M. GRAFFIUS, Alexandria, Pa. For the purpose of preventing the unlocking from any cause of nuts on their bolts, the inventor locks the nut on the bolt by means of a soft-metal spiral spring consisting of a plurality of convolutions, whose pitch corresponds to that of the thread of the bolt, the end of the convolutions being twisted together and around each other to form a finger-piece, the outer edges of which projecting beyond the outer convolutions of the coil.

MILLSTONE-DRESS. — L. B. WOOLEVER, Austinburg, Ohio. In this instance the invention has reference to millstone-dresses; consists of a special or peculiar dressing for millstones, and has for its object certain dressing thereof, whereby increased, improved, and more effective grinding may be made. With this dress the leaders and furrows or grooves are self-sharpening. It has the advantage of being adapted for use on burs constructed of iron and other suitable metal.

COMBINED PIPE-REAMER AND THREAD-CUTTER.—B. H. LINK and C. S. BRENHOLTS, Olean, N. Y. Where a pipe is severed by means of a pipe-cutter, there is usually left upon the inner edge of each severed portion a jagged flange of metal, which should be removed. Again, it is often desirable to render the interior of the pipe bell-shaped and at the same time to thread the pipe exteriorly. These two operations are closly related to each other and are generally performed separately. The more particular object is to produce a neat, compact device which will enable the two operations to be performed simultaneously.

Heating and Lighting.

HEATER.—P. DORAN, Bayonne, N. J. The inventor particularly designs the heating of portions of the frame members of such structures as steel vessels and the like. By use of the invention metal members may be speedily heated to the exact point while they are still assembled, and the lightness of the apparatus enables it to be readily removed from one place to another and supported in its operative position without difficulty.

GRATE.—H. F. LANGENHOP, New York, N. Y. In this case the object is to provide a grate which is simple and durable in construction, very effective in operation, and arranged to enable the attendant to readily and thoroughly rake the burning fuel and free the same from ashes, cinders, and the like, and to insure a ready access of air to the burning fuel to insure complete combustion.

Household Utilities.

BASIN-HOLDER.—O. R. APPLEGATE, Trenton, N. J. The invention refers to devices for holding washbasins and similar receptacles, and is adapted for general use in holding articles of all kinds. Particular objects of the inventor are to provide a device which when not in use may be folded back against the wall or support in any direction, and which will be capable of holding an article at different angles.

FOLDING DEVICE FOR SAD-IRONS.—W. STRAUSS, New York N. Y. By means of this invention a strip of fabric can be expeditiously folded and flattened so as to place it in condition for immediate service in the manufacture of garments. One part of the invention resides in the employment of a support adapted to be easily and quickly fastened to a sad-iron, the support being constructed to hold a folding device in an inclined position directly in front of the iron, so that a length of folded fabric may be fed from the folder to and below the nose of the iron.

Machines and Mechanical Devices.

MACHINE FOR CUTTING DIAMONDS.—J. DE MINISZEWSKI, Kwasow, Stopnica, Kielce, Russia. In this instance the invention relates to an improved machine for cutting diamonds and other hard substances by means of a steel wire turning about itself and coated with a hard material diluted in a suitable fluid, a very slow translating motion being at same time imparted to this wire.

AUTOMATIC PACKAGING-MACHINE.—A. MCLEOD and J. H. MCLEOD, Marietta, Kan. The object in this improvement is to provide a construction whereby filled packages will be taken from one point in the machine to another point, being shaken or agitated in the meantime to settle their contents, the packages being delivered prior to such shaking operation upon a platform of a tripper, which will release the step-by-step mechanism for feeding the packages, and the filled and shaken packages will be delivered by their own gravity on an offtake-belt, dropping onto the belt and clear of funnels or hoppers through which the material is supplied to the packages.

DRAG-SAW.—F. J. SHELDON, Longwood, Wis. In connection with a carriage mounted to move on a frame and carrying the saw and its actuating mechanism, Mr. Sheldon provides a drum and a flexible connection between the drum and framing whereby as the drum is operated the carriage is alternately raised and lowered.

Prime Movers and Their Accessories.

VALVE MECHANISM.—T. G. VAN SANT, Paragould, Ark. The present invention has reference to a valve mechanism for steam-engines; and the principal object of the invention is the provision of an improved cut-off enabling the period of cut-off to be automatically regulated without changing the lead, compression and exhaust.

EXPANSION-PLUG FOR BOILER-TUBES.—G. PETERSON, Birmingham, Ala. The invention relates to devices for closing the ends of leaky boiler-tubes, pipes, and the like; and its object is to provide an expansion-plug which is easily applied at any time without requiring shutting down of the furnace, and arranged to effectively close the end of the leaky tube or pipe, and to allow of convenient removal and reuse of the device.

PACKING.—J. BADEKER, Omaha, Neb. In this patent the invention has reference to a metallic rod-packing, particularly for the piston and valve rods of locomotives; and the object of the improvement is the provision of efficient means for preventing independent movement of the segments constituting the packing-cone. The packing may be applied with facility to the rods of modern compound locomotives.

Railways and Their Accessories.

FLUID-PRESSURE BRAKE.—A. A. KENT, Denver, Col. The primary object in view is to distribute the fluid-pressure to the series of cars of a train proportionately to the varying weights of the loads in the cars. Thus in the case of a car bearing a heavy load an increase in the pressure of the braking fluid in the brake mechanism is obtainable, while a car with a lighter load does not require for the operation of its brake mechanism such high pressure of the braking fluid.

RAIL-JOINT SHOE AND CLAMP.—J. B. ANDERSON, Portland, Ore. In this patent the object of the invention is to provide details of construction for a rail-joint shoe that adapt it to serve as a clamp for holding two track-rails at their joint secured together in alinement and afford effective means for retaining the shoe and clamped rails at a desired point on the cross-ties of a railroad.

Pertaining to Vehicles.

HANDLE-BAR.—R. F. MONAHAN, Buffalo, N. Y. The clutch members in this device are so engaged that the projections upon one are held against one side of the recesses of the other with some force by the torsion of the spring, the direction being such that the pressure of the arms of the rider causes it to yield, absorbing vibration and relieving him from the jar. To adjust tension or force which opposes this yield, the members are separated by outward movement of a sleeve and spring tension increased or diminished by twisting the bar upon the supporting sleeve to an angle at which projections may secure new engagement with the recesses.

ROBE-HOLDER.—N. LIVINGSTON, Cass City, Mich. In this case the improvement refers to devices for retaining robes or similar coverings in place about the occupants of vehicles, its principal object being to provide a readily-ap-

plied holder for this purpose. An arrangement of the looped ends secures a comparatively rigid and strong pivotal support for the rod, while adding little to its weight.

SLEIGH.—A. P. LINN, Escanaba, Mich. Mr. Linn's invention refers to the running part of sleighs, sleds, and all devices adapted to run upon the snow and ice, and it is capable of general use upon articles of the class mentioned. The objects of the improvement are to secure greater rigidity, and cheapness in this class of articles of manufacture. The invention is equally applicable to a sleigh having a running portion consisting of two sleds or to a sleigh having only one set of runners.

DRAFT-TREE.—H. T. REEDER, Missoula, Mont. The purpose here is to provide a tree in which a double whiffletree or a swingletree will not break at the center or pivotal point by reason of a cross pull, as when the draft is on the tree instead of the tension being crosswise of the bar of the tree it will be endwise, thus adding to the lifetime of the device and preventing the tree from breaking under severe tension, under which conditions in the ordinary tree the tension is forward or crosswise directed to the weakest point of the tree —its pivotal point— which under the improved form of draft-tree is reinforced and the tension not directed thereto.

VEHICLE-BRAKE.—W. M. FLEWELLING, Santa Rosa, Cal. The invention is an improvement in brakes for logging-trucks, and is especially designed for use in logging-trucks in which the logs are suspended from the trucks, and the weight of the log operates to hold the beam-carrying bars down in position for the proper operation of the brake when set by means of the devices.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6385.—For parties to manufacture dust pans.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 6386.—For manufacturers of nickel tops for pocket purses.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6387.—For the manufacturers of the electrical machine for making puffed rice.

Perforated Metals. Harrington & King Perforating Co., Chicago.

Inquiry No. 6388.—For manufacturers of leaden hair combs.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6389.—For an apparatus to destroy roll tickets in large quantities.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6390.—For manufacturers of table knives, forks and spoons sold under different names, as Australian silver, Mexican silver, etc.

Leyden Chemical Works. Sole manufacturers of all luminous preparations. 666 East 182d Street, New York.

Inquiry No. 6391.—For makers of lead pencils in large quantities, stamped with name and address, for advertising; samples wanted.

Robert W. Hunt & Co. bureau of consultation, chemical and physical tests and inspection. The Rookery, Chicago.

Inquiry No. 6392.—For the address of the manufacturer of glass which can be heated red hot and plunged in water without breaking.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 6393.—For manufacturers of or dealers in German silver tubing ⅛ inch in diameter.

I have every facility for manufacturing and marketing hardware and housefurnishing specialties. Wm. McDonald, 190 Main St., East Rochester, N. Y.

Inquiry No. 6394.—For sectional posts ⅜ inch diameter, for use in making sectional post binders for loose leaf books.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 6395.—For wholesale dealers or manufacturers of the Handy Wagon Jack.

The SCIENTIFIC AMERICAN SUPPLEMENT is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6396.—For the manufacturers of the Plaza Lawn Mowers.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6397.—For manufacturers of or dealers in machinery and supplies for corn-canning factories.

If you wish to buy patents on inventions or sell them, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 6398.—For makers of telephone pates, also manufacturers of galvanized and telephone wire.

Inquiry No. 6399.—For manufacturers of brick-making plants.

Inquiry No. 6400.—For makers of small brass gears, either cut or stamped.

Inquiry No. 6401.—For apparatus operated by air pressure, such as engines or pumps; a small hand air pump to generate sufficient air pressure in a small tank to give motive power of from 5 to 10 pounds for temporarily raising weight.

Inquiry No. 6402.—For parties manufacturing Bull's Eye lenses, for concrete sidewalk lights.

Inquiry No. 6403.—For makers of hydraulic pumps, sand suckers and siphons.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9516) V. E. M. asks: 1. What is the method of making a small battery such as is used in a small vest-pocket electric light? The battery can be bought for about 25 cents. A. The battery for lighting miniature lamps usually contains two or three dry cells. We published in our SUPPLEMENT, Nos. 1383 and 1387, price 10 cents each, a full description with illustrations of the manner of making such cells, with all the materials used and all necessary instructions. 2. What is the method of making a Fuller battery? A. The Fuller cell (see SUPPLEMENT, No. 159, price 10 cents mailed) is a bichromate cell in which there is a continuous amalgamation of the zinc. The zinc is in the bottom of the porous cup, and has a quantity of mercury, an ounce to a cell will answer, poured around it, which maintains the amalgamation of the zinc through the life of the cell. A brass or copper rod covered with gutta percha is fastened to the zinc, and extends above the cell as a terminal to which the circuit is connected. The carbon plate is placed in the glass jar and surrounded with a bichromate solution. Water is poured into the porous cup upon the zinc. The acid diffuses through the porous cup fast enough to act upon the zinc and produce the current. The cell evidently will not furnish a strong current. A good formula for the bichromate solution may be given: Take 21 ounces of sodium bichromate and 3 quarts of water. When the solution of the salt is complete, add slowly and with constant stirring, 1 pint of strong sulphuric acid. The solution is ready for use when it has cooled.

(9517) W. R. C. writes: State in the column of Notes and Queries if there is any liquid that will dissolve amber that has no oil in it? Something like alcohol, that will soon evaporate. A. We do not think that there is any liquid that will dissolve amber that has no oil in it. We know of none.

(9518) W. D. O. says: I would like to know the composition of the preparation with which the particles of carbon, in the carbon pencils for electric arc lamps, are held together; that is, the cementing substance. A. Arc light carbons, carbon plates for battery cells, and similar articles are made from coke. The higher grades are made from coke derived from the residue of petroleum stills. The crude material is dried, ground fine, and sorted into different sizes. The binding material may be a coal-tar product, or some other substance containing carbon, and which will be reduced to carbon by the heat of the furnace. These are thoroughly mixed, pressed into forms by hydraulic pressure, and afterward baked in a furnace. For a full description see SUPPLEMENT, No. 1237, price ten cents.

(9519) R. S. C. asks: Why, if known, does the skin of a chameleon change in color, in moving from an object of one color to one of another color; that is, why does its skin always assume the same color as the object it may be resting upon? A. One answer to the question, "Why does the chameleon change the color of its skin?" is that the chameleon has a better chance of life by reason of this protective resemblance to its surroundings. Those chameleons which had the largest range of change of color in the past have survived, and the capacity of change has been evolved in their descendants to a higher degree, so that all chameleons now living readily change the color of their skins to that of the bark of the tree upon which they at the time may be. They are thus protected from their enemies. There are many such adaptations of creatures to their habitat or environment. The polar bear, living among Arctic snows, is white. The tiger in the jungles is striped, as if painted to resemble rushes, reeds, or other stiff and straight plants. Many fish have backs of the hue of the sand or sea bottom upon which they lie. Nature has thus attended to the needs of her weaker children. Another answer might be that the effect of the color of the surroundings is to produce a change in the pigment in the cells of the skin, so that the color becomes like that of the surface upon which the animal is resting. In the chameleon this is comparatively rapid.

NEW BOOKS, ETC.

THE TREATMENT OF SEPTIC SEWAGE. By George W. Rafter, M.Am.Soc.C.E. New York: D. Van Nostrand Company, 1904. 32mo.; pp. 137. Price, 50 cents.

The author has endeavored to give, in a limited space, the more important developments in the bacterial treatment of sewage. All the leading works on the subject have been consulted, and the present small volume is a compendium of the information contained in these. The book is non-technical in character, and is intended to give to the everyday person a knowledge of the proper and scientific treatment of sewage.

AUTOMATIC SURVEYING INSTRUMENTS AND THEIR PRACTICAL USES ON LAND AND WATER. By Thomas Ferguson. With an Introduction by E. Hammer, Ph.D., Professor of Geodesy at the Royal Technical High School of Stuttgart. London: John Bale, Sons & Danielsson, Ltd., 1904. 12mo.; pp. 87. Price, $1.60.

This book forms a practical handbook on the use of automatic surveying instruments, such as the pedograph and cyclograph, which are used for the purpose of recording the topography of the country. The instruments and their mode of operation are described in detail, and clearly illustrated by drawings and photographs.

OBSERVATIONS SUR LES FOURMIS. Par Charles Janet. Limoges: Imprimerie-Librairie Ducourtieux et Gout, 1904. 8vo.; pp. 70.

This book contains much information upon ants, their anatomical construction, their length of life, means of subsistence, habits, etc. It is illustrated with about ten full-page plates containing drawings showing the anatomical structure of ants. The book contains considerable scientific information regarding these little insects.

UNTECHNICAL ADDRESSES ON TECHNICAL SUBJECTS. By James Douglass, LL.D. New York: John Wiley & Sons, 1904. 12mo.; pp. 84. Price, $1.

This small volume is made up of three interesting addresses on the following subjects: The Characteristics and Conditions of the Technical Progress of the Nineteenth Century; the Development of American Mining and Metallurgy, and the Equipments of the Training School; and Wastes in Mining and Metallurgy. The first-named paper treats largely of the management of large works and of the methods of treating employes both here and abroad; the second tells of the requirements which will be made of a student after he has left a mining school, and of the methods obtaining in large American mining and metallurgical works; while the third tells of the approved processes and methods now in vogue for utilizing products in ores which heretofore have gone largely to waste. The papers will be found most interesting by all students of mining and metallurgy.

THE LOCOMOTIVE. Hartford, Conn.: The Hartford Steam Boiler Inspection and Steam Boiler Company, 1903. 8vo.; pp. 195.

This book contains the numbers of that excellent monthly, well known to many of our readers—The Locomotive. Much useful information regarding locomotives, boilers, burners, and boiler explosions is contained within its pages. The annual report of the Chief of the Bureau of Steam Engineering for 1902 on oil burners is given in condensed form in the first number of the volume, and is illustrated by large diagrams of the various burners used so successfully in the tests with freight steamers made by this bureau. The paper is too well known to our readers to need further comment, save that all the articles published in it are of an altogether practical character.

DIE MECHANISCHEN VORRICHTUNGEN DER CHEMISCH - TECHNISCHEN BETRIEBE. Von Friedrich Weigand. Illustrated. Octavo. Pp. 416. Price, $2.

Many books have appeared on industrial chemistry, but so far as we know, the appliances of the industrial chemist have not been described in any work. The modern industrial chemist must be something of a mechanical engineer. It is the purpose of this work to describe the mechanical appliances which he employs. This purpose has been accomplished with praiseworthy thoroughness in this newly-issued book of Hartleben's.

ORNAMENTAL TURNING. A Work of Practical Instruction in the Above Art. By J. H. Evans. Three Volumes. London: Guilbert Pitman, 1903. 12mo.; pp., each volume, 165; with numerous engravings and plates. Price, $1.50 each volume.

Followers of this fascinating occupation, and those who simply make of it a hobby, will alike be delighted with these three little volumes. Mr. Evans, well known as a maker of high-class lathes and a professional turner of marked ability, has issued this popular-priced edition of his "Ornamental Turning." The volumes are progressive, Vol. 1 dealing with the simpler processes requiring inexpensive apparatus, while Vols. 2 and 3 initiate the worker into the manipulation of the more costly and efficient chucks and appliances.

MODERN PRACTICAL ELECTRICITY. By R. Mullineux Walmsley, D.Sc., F.R.S.C. Chicago: W. T. Keener & Co., 1904. Quarto; pp. 325. Numerous illustrations; 4 vols. Price, $12.

This book forms Volume IV. of one of the most popular yet practical treatises on the application of electricity in modern life, which we have yet seen. It is written in a simple, concise style, and abundantly illustrated with fine half-tones and numerous diagrams. Volume IV. opens with a continuation of the chapter on the Magnetic Circuit, and also contains chapters on batteries of generators of both the continuous and alternating current types; continuous current motors, of the open, closed, and tramcar types; alternate current motors of the monophase and polyphase induction types; and electrical measurements and dynamo and motor testing. The chapter on electrical measurements contains descriptions of standard meters of all kinds, and discusses in a thorough manner the measurement of electrical energy. The work contains some 325 illustrations, which greatly aid in interpreting the text.

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Battery. See Galvanic battery.
Bearing, ball, C. H. Chapman..... 779,071
Bedstead, A. A. Coburn 779,027
Belt for transmitting power, chain, J. W. Bayliss 779,253
Binder, document, F. Plassmann 779,000
Binder, loose leaf, C. R. Nelson..... 778,992
Binder, temporary, F. Soennecken 778,910
Binder, temporary, E. A. Trussell 779,142
Blind guide, venetian, F. Stern 779,009
Block system, A. Fiorini 779,075
Blotter attachment, J. W. Graeme..... 779,274
Blower, fireplace, H. Borrow 779,114
Boiler tube sheet, G. H. Rheutan 779,136
Boilers, device for preventing the formation of scale in, A. Stewart 779,326
Bolt actuating device, A. Evensen 779,354
Book cover, G. W. Holden 779,161
Bookcase, writing desk, and organ, combination, C. S. Gardner 779,356
Bornyl esters and process of making camphor, etc., Seifert & Philipp..... 779,377
Bottle cork and cap removing device, B. Herman 778,968
Bottle corking machine, W. E. Brown.... 779,347
Bottle, jar, etc., stopper, sheet metal, A. L. Weissenthanner 779,107
Bottle, non-refillable, F. Lieske..... 779,049
Bottle, non-refillable, W. A. Stattmann.. 779,380
Brace, A. S. Miller 779,370
Brake, F. H. Ball 779,111
Bread cutting device, N. M. Andersen... 779,110
Brick cleaning machine, F. T. Leeder..... 779,224
Brick making machinery, Wallis & Fox... 779,014
Broom holder, M. W. Hyenga..... 778,865
Brush, bottle washing, A. R. Wiens..... 778,931
Bucket, miner's dinner, J. F. McNiel 778,883
Bucket motor control, hoisting, Robb & Rosewater 778,897
Buckle, C. L. Hastings 779,279
Building block making machine, E. E. Hartwick 779,219
Building construction, A. C. Warren..... 778,926
Building construction, C. R. Elliott 779,268
Bung, G. W. Jackson..... 778,974
Bur wheel, R. W. Gormly 778,857
Burglar alarm, electric, F. S. Holmes.... 778,971
Button, J. Horan 779,283
Cabinet, kitchen, H. Klein 779,125
Cake turner, pan, C. H. Seffens 778,904
Calculating machine, J. P. Harrison, Jr... 778,965
Calculating machine, C. E. Locke..... 779,088
Can, L. C. Sharp 779,322
Candy pulling machine, C. Thibodeau.... 779,141
Car bolster, A. B. Bellows 779,389
Car draft rigging, railway, A. Wackman.. 779,012
Car draft rigging, railway, J. E. Guinn.. 779,038
Car dump, E. Bivert 779,391
Car fender, Fullipp & Huszka..... 779,213
Car, railway, Harding & Howard..... 778,964
Car, railway, Howard & Floyd 778,973
Car underframing, Williamson & Pries... 778,932
Carbureter, F. L. Merritt 778,988
Caster, ball, F. S. Thornley 779,330
Casting machine, metal, C. Vellino..... 779,192
Cell, dry, W. Stockigt 778,912
Cement pipe, J. H. MacDonald 779,169
Cement pipe mold, L. Shell 778,907
Chain, cable, or wire stretcher, Smith & Waterston 779,007
Chair. See Folding chair.
Chandelier, extensible, G. W. Pond..... 779,132
Chopper, M. S. Sober 779,325
Chuck, reversible, D. E. Kempster 779,047
Churn, A. C. Roberts 779,053
Cigar bunch shaping machine, J. D. Lacroix 779,368
Circuit breaker and starting rheostat, combined, R. H. Read 779,182
Circuit breaker, automatic magnetic, W. M. Scott 779,003, 779,376
Circuit closer and opener, dust proof automatic, U. G. King 779,222
Circuit controlling apparatus, time, J. M. Anderson 779,249
Clamp feeding device, J. J. Foss 778,961
Clamp for handling metallic or other vessels. Love & McRae 779,297
Clasp, M. L. Senderling 779,100
Clay product and process therefor, D. B. Williams 779,196
Clay, treating, D. B. Williams 779,195
Clevis, Morrison & Callison 779,094
Clips, mechanism for the manufacture of, J. Nazel 779,096
Closet attachment, C. G. Lanaux 779,048
Cloth clamp for textile machinery, H. L. Quick 779,133
Clothes line fastener, G. Mathis 779,172
Clothes line stick or stretcher, L. D. Mouser 779,234
Clutch, friction, R. M. Phillips 779,057

THE PROTECTION OF ONE MILLION FAMILIES

New York Life Insurance Co.

=1845= JOHN A. McCALL, President. =1905=

This Company is Sixty Years old. The Sixtieth Report, covering the year 1904 and describing the assets in detail, is now ready. It will be mailed to any address on request.

1904 was the most prosperous year in the Company's history.

New paid business during 1904 exceeded 342 million dollars of insurance. This is 15 millions more than the new paid business of any previous year, by this Company; and 100 millions more than the new paid business of any previous year by any other regular life insurance company.

The expense ratio for 1904 is lower than for 1903.

This Company is purely mutual; it has no Capital Stock. The policy-holders are the Company and own the assets. Their title to the assets is recorded in 925,000 policies. The policies average about $2,100 each.

This Company has returned to its policy-holders since organization in 1845 over 450 million dollars.

Cash payments to policy-holders during the single year 1904 amounted to over 40 million dollars. In addition the Company loaned to policy-holders during the year on the sole security of their policies 17 million dollars.

The accumulations under 925,000 policies amount to 390 million dollars, cost value, an average of $420 per policy. These accumulations are required by law and for the fulfilment of the Company's obligations under these policies.

The Bonds owned aggregate at par 288 million dollars; they cost 287 million dollars; their market value is 294 million dollars. Not a single Bond is in default of interest.

This Company does not invest in stocks or industrial securities of any kind.

This Company files its Detailed Annual Report with the Department of Commerce and Labor of the United States; with the Insurance Department of the State of New York; with each one of the State Insurance Departments in the United States, and with the Governments of all the civilized countries of the world.

This Report, in all its details, including investments and general management, is therefore scrutinized by the severest Court of Critics in the world. No other list of securities held for any purpose presents so many official certificates of approval.

BALANCE SHEET, JANUARY 1, 1905.

ASSETS.

Government, State, City, County and other Bonds, cost value, (MARKET VALUE, $294,309,761), (Company does not include in Assets the excess $7,247,377 of market value of Bonds owned over cost).	$287,062,384
Bonds and Mortgages (413 first liens)	23,595,105
Deposits in 489 Banks throughout the world (at interest $15,241,793)	17,694,110
Loans to Policy-holders on Policies as security (reserve value thereof, $50,000,000)	35,867,475
Real Estate, 23 pieces (including eleven office buildings, valued at $10,940,000)	13,257,500
Quarterly and Semi-Annual Premiums not yet due, reserve charged in Liabilities	4,086,171
Premium Notes on Policies in force (Legal Reserve to secure same, $5,500,000)	3,331,618
Premiums in transit, reserve charged in Liabilities	2,746,326
Interest and Rents accrued	2,469,571
Loans on Bonds (market value, $783,565) (Company does not invest in stocks.)	550,000
Total Assets	**$390,660,260**

LIABILITIES.

Policy Reserve (per certificate of New York Insurance Dept.), Dec. 31, 1904		$336,222,459
All other Liabilities on Policies, Annuities, Endowments, etc., awaiting presentation for payment		6,909,661
Reserve on Policies which the Company voluntarily sets aside in excess of the State's requirements	$6,830,028	
Reserve to provide Dividends payable to Policy-holders during 1905, and thereafter, as the periods mature:		
To holders of 20-Year Period Policies	24,982,787	
To holders of 15-Year Period Policies	5,736,259	
To holders of 10-Year Period Policies	344,601	
To holders of 5-Year Period Policies	303,837	
To holders of Annual Dividend Policies	868,953	
Reserve to provide for all other contingencies	8,461,680	
Total (not including $7,247,377 excess of market value of Bonds owned over cost)		47 528,140
Total Liabilities,		**$390,660,260**

INCOME, 1904.

New Premiums	$16,133,824	
Renewal Premiums	64,422,754	
TOTAL PREMIUMS		$80,556,578
Interest Receipts from:		
Bonds owned	$10,634,987	
Mortgage loans	1,069,232	
Loan to Policy-holders secured by Policies,	1,943,063	
Bank Deposits and Collateral Loans	702,056	
TOTAL INTEREST RECEIPTS		14,349,338
Rents from Company's properties		946,723
Profits realized on Securities sold during the year		499,688
Deposits on account of Registered Bond Policies, etc.		538.945
Total Cash Income		**$96,891,272**

DISBURSEMENTS, 1904.

Paid for Death-Claims ($19,734,245), Endowments, ($5,051,629), and Annuities ($1,723,160)	$26,509,034
Paid for Dividends ($5,989,491), Surrender Values ($7,790,058) and other Payments ($95,279) to Policy-holders	13,874,828
Commissions and all other payments to agents, $7,276,850 (on New Business of year $342,212,569); Medical Examiners' Fees $788,761, and Inspection of Risks $178,155	8,243,766
Home and Branch Office Expenses, Taxes, Legal Fees, Advertising, Equipment Account, Telegraph, Postage, Commissions on $1,586,396,739 of Old Business and Miscellaneous Expenditures	11.204,101
* TOTAL DISBURSEMENTS	$59,831,729
Balance for Reserves—Excess of Income over Disbursements for year	37,059,543
*The Expense ratio for 1904 is lower than for 1903.	
Total Disbursements and Balance for Reserves,	**$96,891,272**

New Business Paid for in 1904 (185,367 Policies) - $342,212,569

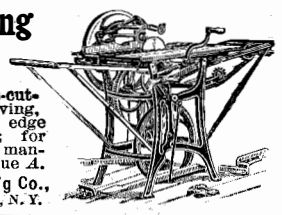
GAIN IN 1904 (4,249 Policies) $15,554,323

Total Paid-for Insurance in force (924,712 Policies) $1,928,609,308

GAIN IN 1904 (112,001 Policies) $183,396,409

Coal or similar substances, breaking or sizing and distributing, J. Campbell	779,205
Coat hanger, R. P. Beatty	779,062
Coat hanger, R. Eyres	779,270
Cock, safety gas, B. F. Clarke	779,072
Coin wrapper, J. Gearing	779,155
Coin wrapper, H. Lohse	779,292
Coking, A. Custodis	778,846
Collar pad, horse, P. Hoffmann	779,041
Compressor, W. P. Valentine	779,385
Concentrator, Dillon & Wilson	778,847
Concrete construction, adjustable mold for reinforced, J. C. Russell	779,319
Concrete wall forming apparatus, L. Lane	779,288
Control system, F. E. Case	779,206
Conveyer for solid materials, A. L. Putnam	779,313
Conveyer, portable, C. H. Spence	779,139
Cooker, steam, J. Kingory	778,978
Cork for the manufacture of cork fabric, treatment of, R. A. Grimoin-Sanson	779,277
Corset, L. Perotti	779,177
Cotton handling apparatus, pneumatic, R. B. Lumpkin	778,983
Cotton picking machine, J. N. McEachern	779,129
Cow tail holder, M. W. Hyenga	778,864
Cradle, automatic, L. Perotti	779,179
Cream separator, centrifugal, G. T. Rennerfelt	779,099
Cultivator or plow frame, J. F. Bowers	779,115
Cultivator tooth, S. E. Auker	779,060
Current controlling system, A. C. Eastwood	779,267
Current meter, W. S. Blauvelt	779,255
Current motor, G. Samuelson	779,320
Curtain appliance, automatic safety, Garnsey & Tracy	778,852
Dental mouth mirror, A. Littauer	778,981
Dental tool holder, R. M. Dunlevy	778,955
Desk, E. A. Cannon	778,950
Distillation and treatment of crude bituminous material, H. W. Ash	779,197
Distilling crude bituminous material, H. W. Ash	779,198
Door closing device, double, F. M. Edmonds	778,959
Door for cold storage rooms, rotary, J. F. Drucker	779,209
Door, grain, Bogard & Maple	778,946
Door guideway, sliding, N. C. Schommer	778,902
Door or gate, laterally moving, J. M. Cornell	778,952
Door releasing device, electrical, F. M. Edmonds	778,958
Dough mixing machine, L. St. Jean	779,010
Dovetailing machine, F. J. Renz	779,183
Draft equalizer, C. Wernecke	779,334
Drawing table, J. D. Lugosch	778,872
Dredges, tumbler for, R. G. Hanford	779,361
Drier, C. H. Caspar	779,264
Drill frame, H. F. Moore	779,174
Drill or tool holder, A. Jones	779,084
Drill shoe pressure device, W. Fetzer	779,212
Drilling and sampling apparatus, R. Baggaley	779,251
Drip cup, L. M. Beck	779,200
Dyeing, H. Mann	779,228
Easel and hanger for cups and saucers, J. E. Twichell	779,332
Electric generating unit, S. Shaw	779,054
Electric machine brush holder, dynamo, F. M. Conlee	779,265
Electric plug, N. H. Raymond	779,098
Electrical machine, static influence, E. Thomson	779,190
Electrical machines, means for ventilating, A. Aichele	778,834
Electrical resistance testing apparatus, West & Du Bois	779,247
Electrodes, making spongy lead for secondary battery, C. J. Reed	778,894
Electrolytic apparatus, C. P. Townsend	779,383
Electrolytic process, C. P. Townsend	779,384
Elevated carrier, L. F. Wilson	778,935
Engine, G. H. Collier	779,349
Engine or motor starting mechanism, W. Hagspiel	779,216
Engine sparking igniter, internal combustion, H. Devlin	779,207
Engine speed regulator, explosive, A. Bougault	779,256
Engines, mechanical movement for gas, H. M. Svebilius	779,328
Envelop, L. Reinhold	779,135
Evener coupling, O. A. & J. B. Fladby	779,035
Excavating apparatus, G. H. Hulett	779,043
Excavator and loader, J. Sampson	779,239
Extraction of soluble material, apparatus for continuous, E. Bataille	779,022
Fabrics with fluids, apparatus for treating, J. Gebauer	779,076
Farm gate, F. Hopkins	778,972
Feed water heater, R. H. Fraser	779,122
Fence post, G. L. Turner	779,057
Fence post, J. Rogers	779,318
Fence post, C. A. Chamberlin	779,399
Fence tie forming die, Bugbee & Griffin	778,844
Fence tool, wire, L. H. Kennard	779,221
Fertilizer distributer. C. B. Rozar	779,137
Fertilizer distributer, J. M. Brasington	779,259
Figured fabric, J. Morton	779,300
File, card, L. Senge	779,102
File, letter, L. Senge	779,101
Filter, C. Wahnsiedler	779,013
Filter, F. O. & E. Bendix	779,346
Filter and purifier, Blackmarr & Willford	779,201
Fire escape, B B. Briggs	779,067
Fire escape, B. Johnson	779,284
Fires on ships or the like, means for extinguishing, H. Gronwald, et al	779,157
Fireproof buildings, wall for the interior of, F. C. Caine	779,117
Fireproof ceiling or the like, J. Nolte	778,885
Fireproof window, automatic, J. W. Watkins	778,927
First aid packet, W. M. Davis	779,266
Fish hook, G. R. Mathews	778,875
Fishing tackle, W. Kramer	779,286
Folding chair, J. H. Stiggleman	779,327
Forgings, machine for removing scale from, Kelly & Goeller	779,166
Fruit picker, A. B. Pratt	779,312
Furnace, C. McMillan	779,371
Furnace door opener, Mummey & Fisher	779,128
Furnaces, frame for covers for crucible steel melting, C. W. Cowen, et al	779,074
Galvanic battery, C. J. Reed	778,893
Game, educational, R. W. Mansfield	779,229
Garbage burner and water heater, combined, J. J. Dube	778,954
Garbage can, N. N. S. Matcovitch	779,051
Garment clasp, J. H. Pithey	779,311
Garment hanger, I. Mendel	778,986
Garment supporter, E. C. Woolley	778,937
Gas burner cut off, automatic, H. Smith	779,006
Gas engine. G. A. Bronder	779,116
Gas meter, constant level, J. R. Dupoy	779,352
Gas or other fluid meters, coin freed mechanism for, Beale & Bagnall	779,254
Gas or vapor burner, A. Nurnberg	778,994
Gate, K. K. Lerol, Jr	779,225
Gear, reversing and variable speed, J. O. Hobbs	778,859
Glass blowing machine, R. J. Main	779,089
Glass bodies, apparatus for finishing pressed, J. Hecker	779,159
Glass clamp, W. A. Fair	779,211
Glass, forming sheet, H. J. Hays	779,280
Glass pot furnace, W. T. Nicholls	779,235
Gold saving apparatus, E. S. Kelley	779,365
Governor, automatic, G. F. Welivar	778,930
Governor, engine, D. W. Payne	779,373
Grain cleaner, L. Holland-Letz	778,970
Grain cleaner, W. C. Schad	779,240
Grain drill gang press attachment, W. A. Van Brunt	779,143
Grinding or polishing roll, C. B. Wattles	779,386
Hair drying apparatus, Peter & von Kempski Racoszyn	778,888
Handle. See Knife handle.	
Harrow, sulky spring tooth, C. S. Sharp	779,378
Harvester bundle carrier, corn, H. R. Ingledue	779,162
Harvester, corn, J. E. Goodhue	779,078
Hat brim curling machine, R. G. & G. Segschneider	779,242
Hat fastener, L. Perotti	779,180
Hat pin, etc., attachment, C. T. Hofer	779,160
Hat stretcher, M. W. Boyle	779,258
Headlight, F. Buchanan	779,068
Heating, adjustable pressure, E. H. Gold	779,358
Heating appliance, J. D. York	779,018
Heating furnace, A. L. Yates	778,939
Hoisting apparatus, A. M. Green	779,275
Horn, amplifying, C. J. Eichhorn	779,033
Horse exercising apparatus, W. Smith	779,243
Horse releaser, Duncan & Williams	779,337
Horseshoe attachment, E. L. Abbott	779,148
Horseshoe, cushion, A. Simmons	778,909
Hose coupling, C. B. J. Witmond	778,936
Hot air register, T. M. Dils, reissue	12,299
Hydrocarbon burner, R. Matheson	778,874
Hydrocarbon burner, H. F. Blanchard, 779,064,	779,065
Induction coil, J. G. Meyers	779,231
Ingot charging crane, C. L. Taylor	778,917
Insecticide, R. L. Odom	779,236
Insulated railway rail joint, R. G. Braine	779,066
Irrigating apparatus, W. F. Pope	779,052
Jar and closure therefor, R. H. McCoy	778,989
Jar and dipper for serving crushed fruit or the like, R. Faries	779,271
Jar closure, A. L. Weissenthanner	779,108
Jar holder, F. M. Matteson	778,876
Jar wrench, J. Nelson	778,884
Jewelry fastening, J. N. Provenzano	779,181
Journal box, T. E. Amburn	779,248
Keyed instrument, E. Laemerhirt	779,287
Knife handle, Hodges & Hastings, Sr	778,860
Knob, screwless, A. Arens	778,942
Knockdown brace, adjustable, G. M. D. Heard	779,079
Lace trimming making machine, M. N. Aaron	779,109
Lamp and burner for lighting purposes, A. Nurnberg	778,993
Lamp bracket, electric, E. H. Lux	778,984
Lamp, electric arc, B. A. Stowe..778,914,	778,915
Lamp rheostat, electric arc, B. A. Stowe	778,913
Lamps, automatic suspension and contact appliance for electric arc, J. Stevenson, Jr.	778,911
Lantern, magic, W. Rausch	778,891
Latch, spring, F. Fessler	779,355
Lead, electrolytically refining, A. G. Betts, reissue	12,301
Lead ores, reducing, P. G. Salom	778,901
Lead silicofluorid, making, W. Mills.779,091	779,092
Leaf spring, S. W. Baldwin.....779,020,	779,021
Leather or like material, apparatus for stretching and drying, P. H. Grimm	779,359
Leather stretching device, G. B. Rowbotham	778,900
Level, fluid or spirit, B. Kern, Jr	778,867
Lime grout, cement, and the like, apparatus for forcing, E. W. Moir	778,878
Line spacing device, Benicke & Westerbeck	779,063
Liquid dropper, L. Perotti	779,178
Liquid heater or cooler, J. G. Bouchard	778,842
Lock, L. Faust	779,151
Lock, B. F. Merritt	779,173
Logging cars, etc., holdfast device for, E. W. Fuhr	779,036
Loom, W. R. Burrows	779,025
Loom for weaving embroidered goods, J. B. Monnet, et al	778,880
Loom for weaving pile fabrics, W. G. Hartley	778,966
Loom harness, P. A. Wagner	779,193
Loom let off and take up mechanism, W. R. Burrows	779,397
Lubricating, W. J. F. de Rijk	779,315
Lubricator, Byrd & Travis	779,026
Lubricator, T. J. Hart	779,039
Lumber handling apparatus, G. E. Dupee	778,956
Malt kiln, J. & A. J. Braun	779,395
Malting drum, F. B. Giesler	778,854
Manifolding apparatus, M. F. Horine	779,042
Massage apparatus, pneumatic, I. Rhodes	778,896
Match box, E. C. Carris	779,348
Match making machine, J. C. Donnelly	778,953
Material and manufacturing same, F. F. Pulver	779,375
Mechanical movement, H. Brammer	778,843
Mechanical movement, P. Goldmann.778,855,	778,856
Mechanical movement, J. J. Rexroth	778,895
Metal polishing machine, H. Schuessler	779,321
Metal tubes for the manufacture of paint brushes, etc., grooving or necking, A. L. Watkins	779,016
Metal values contained in slags and mine waters, recovering together the, R. Baggaley	779,252
Metal wheels, machine for manufacturing, J. H. Haskins	778,967
Metals from their ores, obtaining, S. Peacock	779,310
Metallic compounds from solutions, recovering, Vaughen & Cabot	779,058
Metallic tie, J. J. Evans	779,269
Meter. See Current meter.	
Mine cage, Thielmann & Meisenburg	778,919
Mineral wool, manufacturing, T. B. Parkison	779,307
Miter box, A. von Gunten	779,333
Molder's implement, E. Itterley	778,866
Motor controller, C. E. Barry	779,199
Muffler, exhaust, Buchner & McClure	779,024
Music leaf turner and holder, H. O. Stevens	779,381
Music roll perforating device, H. P. Ball, 778,835,	778,836
Music sheets, driving gear wheel for, A. Junghans	779,165
Musical instrument, automatically played, E. Hopkinson	779,080
Musical instrument, self playing, H. W. Shonnard	778,908
Musical instrument, stringed, H. F. T. Muller	778,882
Musical instrument, stringed, L. E. Watford	779,015
Needle threader, R. D. Melrose	778,985
Needle threader, W. P. Slensby	779,103
Nut, axle, B. G. Butler	779,263
Nut lock, J. C. Gary	778,853
Nut lock, M. P. Carpenter	779,118
Oil burner, De Remer & Robinson	779,029
Oil can, Morris & McClair	779,299
Oil cup, W. H. Wilkinson	779,336
Oil cup, L. S. Gardner	779,357
Oil separator, A. C. Calkins	779,398
Ore crushing mill, roller, G. Johnston	779,045
Ore for metallurgical purposes, forming blocks of, A. Ronay	778,899
Paper box or receptacle, J. F. Donley	779,208
Paper, carbon transfer, C. L. A. Brasseur	778,947
Paper removing apparatus, wall, P. Wayts	779,194
Paper spool, J. O'Connor	778,995
Pawl mechanism, ratchet, H. G. Beede	778,943
Pen feeder, fountain, G. S. Parker	778,997
Penholder, W. Huber	779,082
Photographic developing apparatus, C. H. Shaw	778,906
Photographic plates or films in daylight, apparatus for developing and fixing, Hall & Zwieback	779,217
Piano pedal mounting, G. Bjorklund	779,393
Photographic printing apparatus, N. D. Wyman	778,938
Piano player, F. Sheppy	779,323
Piano playing attachment roller, A. F. Larson	778,979
Picture apparatus, moving, C. F. Jenkins	779,364
Picture frame, G. K. Kelsea	779,366
Picture support, J. W. Thompson	778,920
Pie dampening device, P. Koschig	778,869
Pile fabrics, machine for cutting open the weft loops of, P. Hertzog	779,040
Pile turning device, C. L. Taylor	778,918
Pillar, A. Vetterly	778,925
Pipe cutter, cast metal, J. F. Oliver	779,305
Pipe root cutter, drain, W. Schussler	778,903
Pipe wrench, I. D. Green	779,276
Pipes, automatic thaw out for water, W. J. Robinson	779,316
Pitman coupling, O. A. Johnson	778,977
Plane, J. A. Traut	778,921
Plane, O. Bjordal	779,392
Plane, bench, A. St. John	779,246
Planing machine, H. Parsons	779,131
Planter, T. H. Leonard	778,870
Planter, corn, M. Zimmerman	779,147
Plow, gang, H. C. Luecke	778,982
Plow, reversible disk, R. C. Belk	778,838
Plug, heaving, G. W. Barnes	779,388
Pneumatic spring, H. E. Irwin	779,163
Polishing tool, C. A. L. Saunders	779,186
Post. See Fence post.	
Power generating apparatus, E. Thomson	779,189
Press drill, C. H. Pelton	778,999
Printing and folding machine, W. Scott	779,138
Printing machines, revolving carrier for the numbering heads for, E. J. Barker	778,837
Printing press attachment, J. H. Tifft	779,331
Printing press attachment, S. R. Kramer	779,367

Wood-working Machinery



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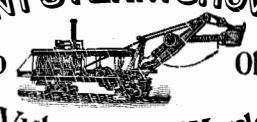
Toledo  Ohio, U.S.A.
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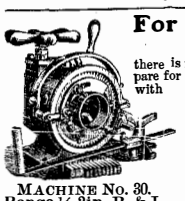

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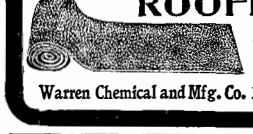
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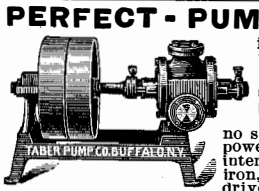

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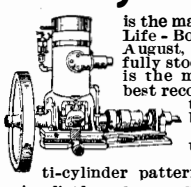

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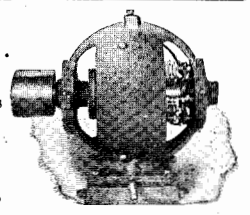

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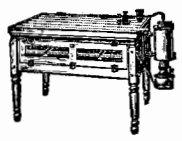

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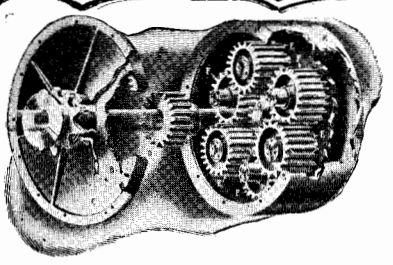

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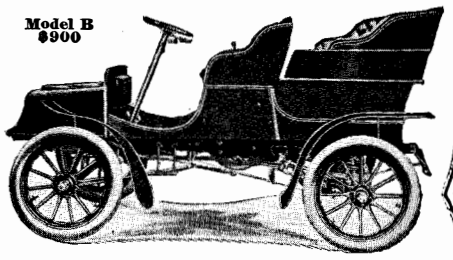

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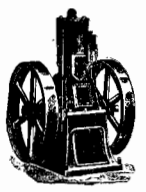

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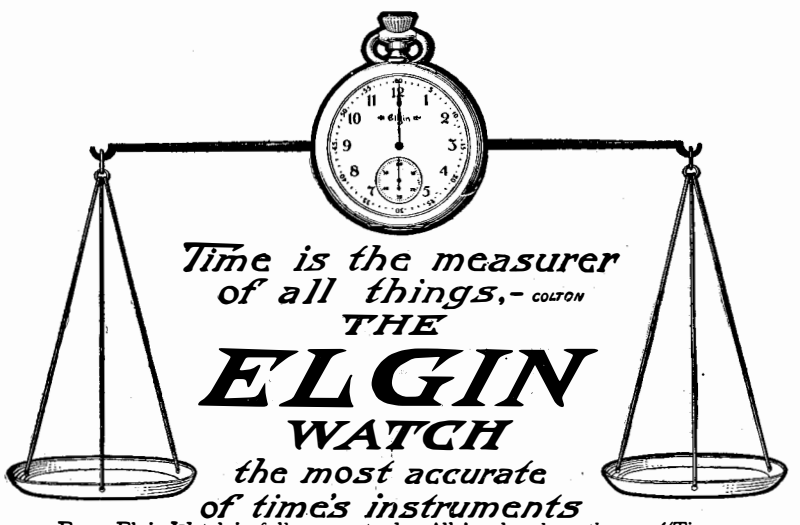

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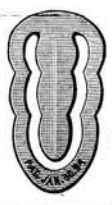

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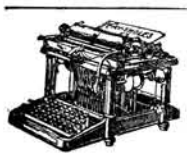

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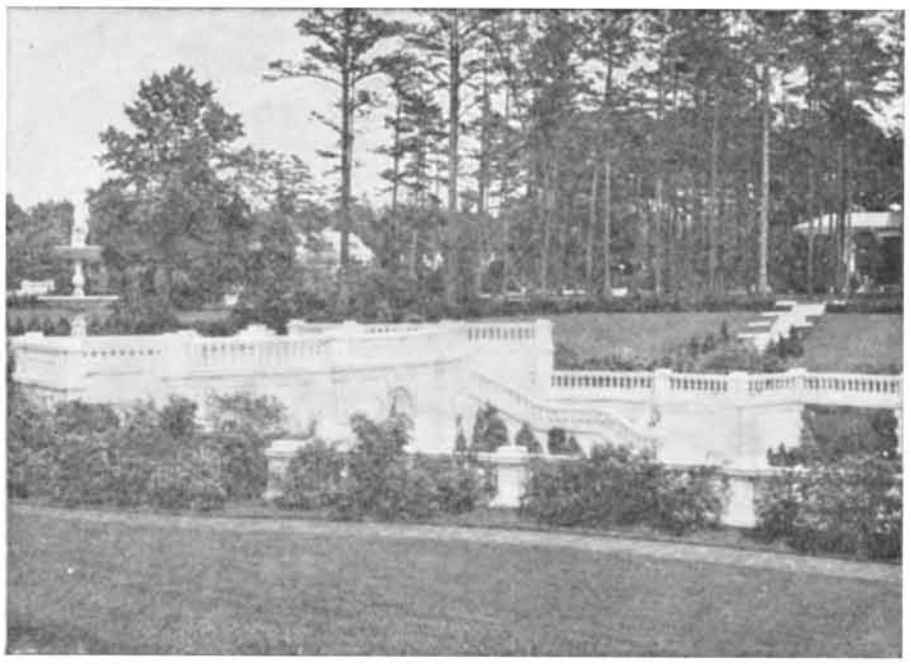

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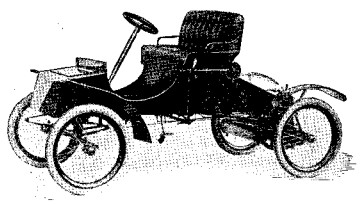

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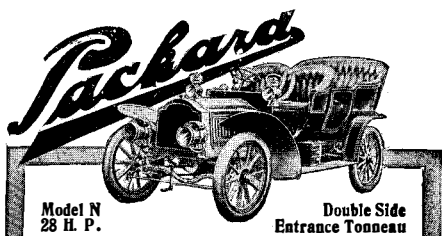

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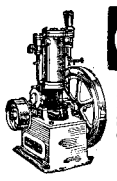

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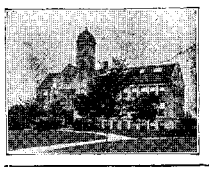

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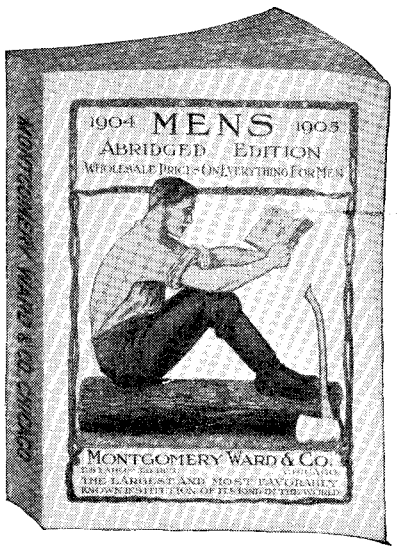
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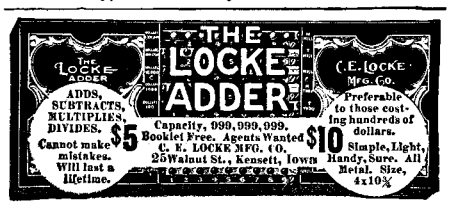
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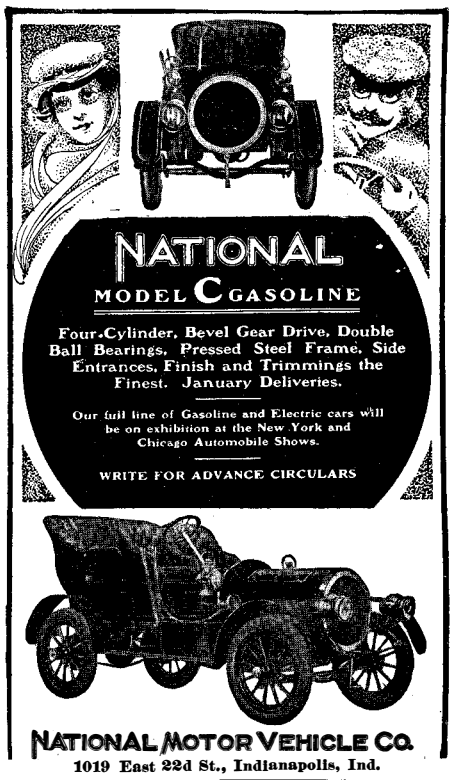
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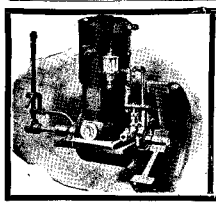

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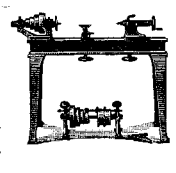

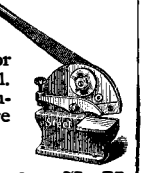

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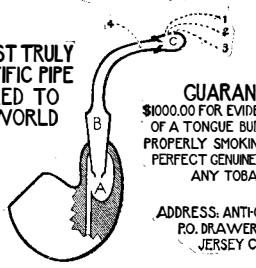
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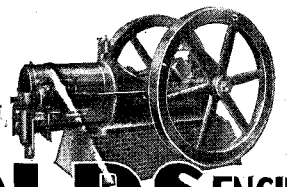

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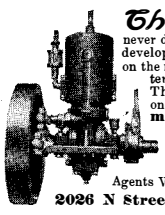

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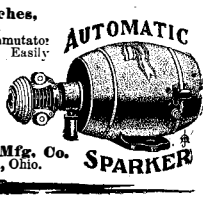

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